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VOL. I. INDIANAPOLIS, IND., APRIL, 1891. No. 11.

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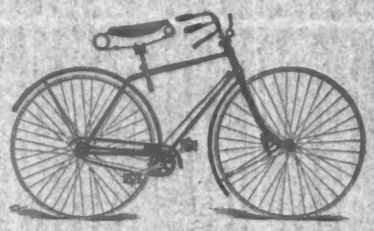

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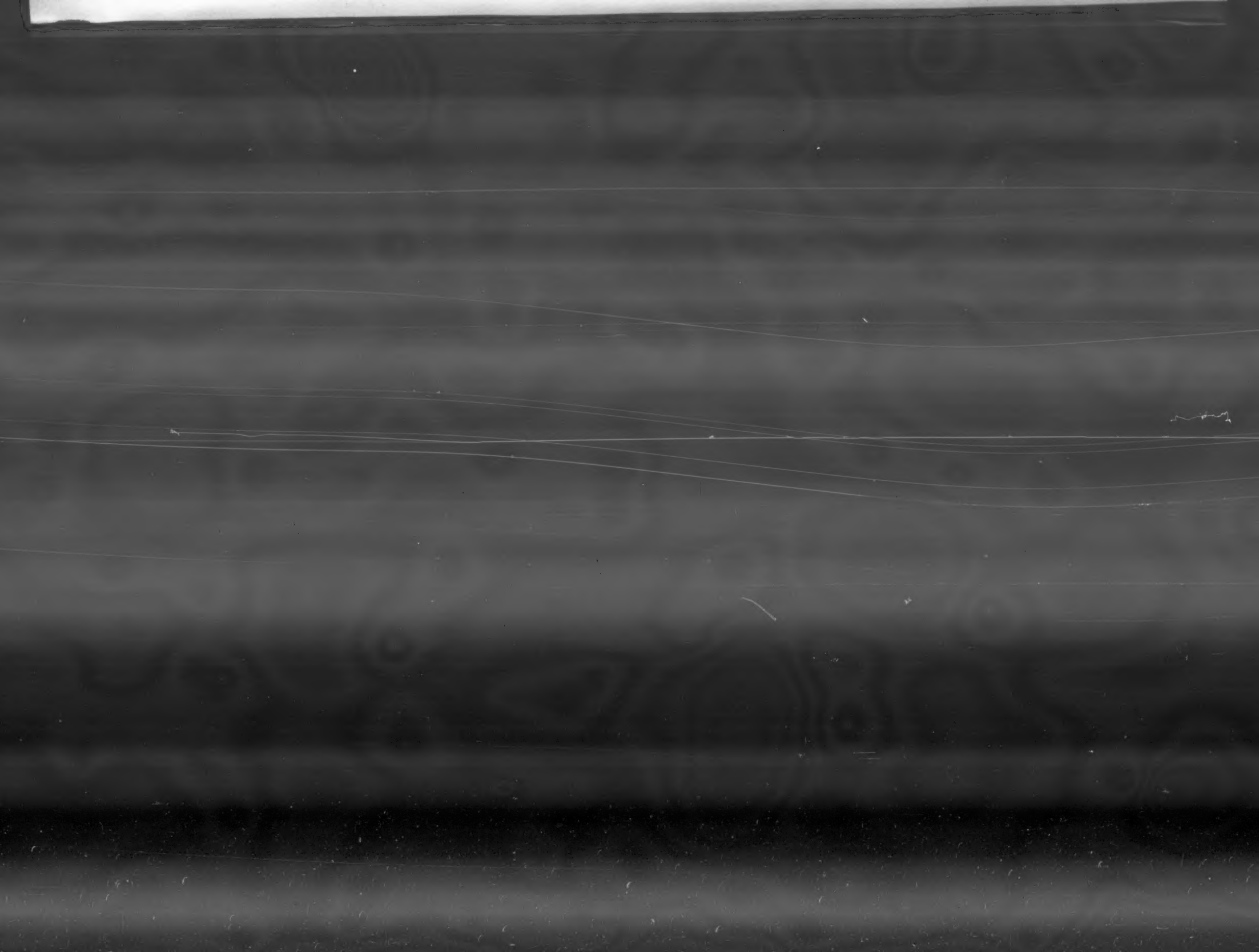

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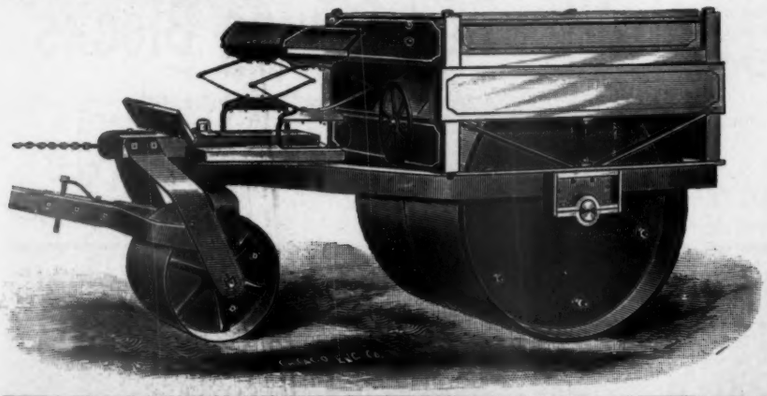

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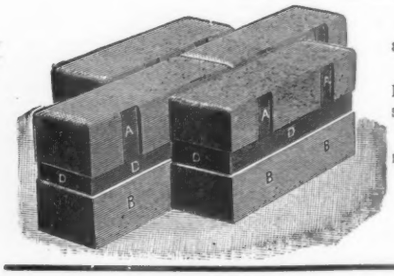

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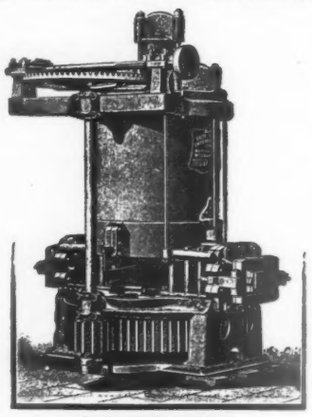

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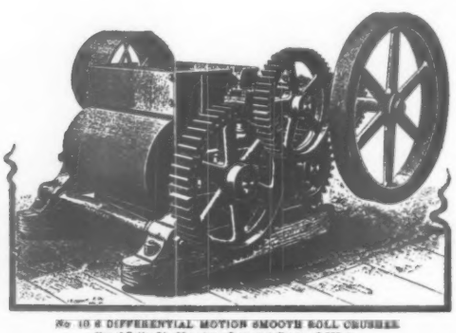

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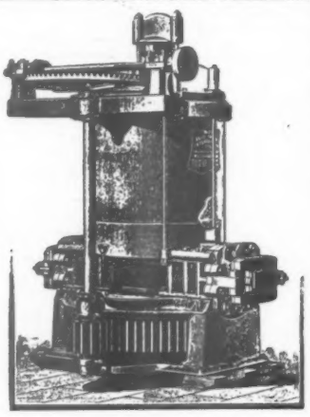

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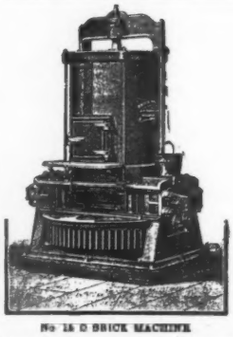

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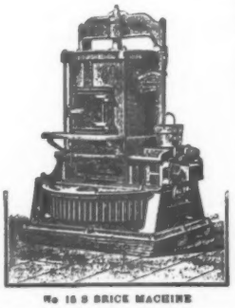

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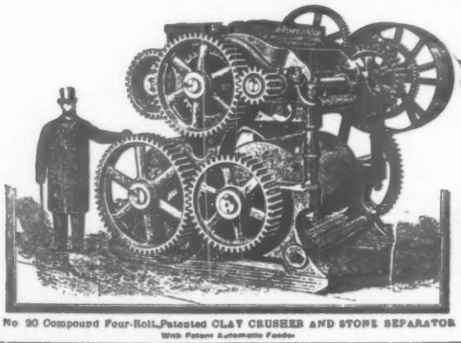

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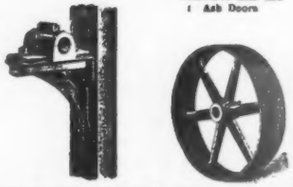

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Articles relating to the different branches of municipal engineering are desired. Stamps should accompany manuscripts for return postage if unavailable.

Vol. I. INDIANAPOLIS, IND., APRIL, 1891. No. 11.

CONTENTS.

	PAGE.
The Streets and Sidewalks of Paris.....*Louis H. Gibson.*	207
The Inauguration and Execution of the Work of Brick Paving.....*Chas. P. Chase.*	208
Sidewalks.....*F. M. Pickering.*	209
Municipal Engineering in Denver	210
Size of Paving Brick	210
A New Plan of Highway Construction	211
What Good Roads Are Worth	211
Relaying a Water Main	212
Asphalt and Wood Pavements in Europe	213
An Old Sewer	213
A New Pavement	214
Ohio's Law for the Protection of Roads	214
Better Roads in Illinois	214
Roads and Bridges in Massachusetts	214
For Municipal Improvements	214
New Move by the Engineering Association of the South	215
Sewerage of Indianapolis	215
The Paving Brick Trade	215
Public Work in Toledo, O	215
Sapless Cedar Blocks	215
Pavements in St. Louis	216
Cement *vs.* Wet and Dry Sand	217
Engineering Association of the South	217
Instruction in Highway Engineering	217
A Journal for Contractors	217
Dangerous Use of Street Sweepings	217
Street Cleaning in New York	217
Public Work in Omaha	217
Personal	217
A New Sewer Pipe Constructor	217
IMPROVEMENT AND CONTRACTING NEWS—	
Paving	218
Sewerage	218
Water-works	219
Bridges	219
Street Lighting	219
Street Railways	220

The columns of this publication are open to the discussion of all subjects relating to paving, sewerage, water-works, street-lighting, and the physical improvement of cities. Practical information as to the merits of materials used in such work and new methods, with photographs and drawings, which may be used for illustration, are especially desired. We are glad to get brief notes as to proposed improvements and the letting of large contracts.

City engineers are requested to send us as early as possible copies of their annual reports, which will be given proper notice.

Articles relating to methods of road making and maintenance are invited.

THE STREETS AND SIDEWALKS OF PARIS.

By Louis H. Gibson.

WHEN the streets of Paris are mentioned in America, the thought of cleanliness and asphalt is brought to the mind of the hearer. The fact is, the streets of Paris are not phenomenally clean, as compared with some other European cities, nor are they largely of asphalt. Asphalt is used liberally but not in the streets. Its principal use is for sidewalks, but in a way quite different from that common in America. Avenue De L' Opera, one of the new streets of Paris, which was opened up by the government some years ago, and which starts from in front of the government Opera House and leads down to the Louvre, one of the most fashionable streets in Paris, the one in which there is the heaviest travel, has a wooden block pavement. It has been in use for several years, and is in good condition. It would be like a committee of council of an American city to find out how this pavement was made, the details of its composition, put down one like it and expect it to last an equally long time. One can put down a pavement in America of the same material, with the same foundation and all that is used in the Avenue De L' Opera and yet have a street which will fail within a short time. The reason for this is that we do not take care of our streets. We put them down and then expect them to last for as long a time as in some other city where they are properly cared for after they are laid. There are asphalt pavements leading into Avenue De L' Opera which are in good condition. There are also granite pavements which are quite as satisfactory.

I do not believe that the asphalt pavement here is laid any more carefully than with us. They are made a little differently, possibly with better material. As to this, I do not know. However, there is not as much asphalt used as with us. There is first the foundation of sand and gravel, then a layer six or eight inches thick of concrete, and on top of this two or three inches of asphalt. This is certainly not as elaborate in its general make up as was put on Ohio street in Indianapolis. There, there was a foundation of broken stone over the rolled bed, then the concrete base followed by the trinidad or tar surface, and then a final covering of asphalt.

Now, the difference between the Ohio street pavement and the pavement in Paris is this, as soon as a failure appears in the Paris pavement it is cut out, a new foundation is put in, and a patch of asphalt appears. One sees patches on all the streets. It is assumed that foundations can not be uniform and that renewals will be necessary, and they are made as soon as the failures appear. This applies to wooden block, stone and other pavements.

I have been in Paris two months. Since I came here a new pavement has been put in one of the courts of the Louvre which is subjected to heavy travel. It is of stone. The new work, as a whole, was put in about six weeks ago. In going through there to-day, I saw two or three men taking out blocks and putting others in their place. I noticed that the blocks had spalled in some instances, and that in others they had split. In taking them out the bed below them was removed, broken stone and cement was rammed in its place and new blocks were put on top. If this had been left to itself, there would have been a chuck hole or deep depression there within a few days. The low place would have formed a rut which, as soon as the wheel of a heavy bus had struck it, would have mashed down and split the stone next to it, and thus a large bad place would have made its appearance. However, these people are old enough in street building to know that foundations can not be uniform and that renewals are necessary, and that, when necessary, they should be made at once. It is not a matter for discussion; it is not a question as to who made the street, but as to how quick it can be repaired. Little places which result in failures, such as this, can not be protected by the contractor. They are not the result of intentional fraud or neglect. They happen because one part of the foundation is not exactly as solid as another, and no one can tell just exactly where the weakness is.

If the contractor is held responsible for little things of this kind he must assume that they will be quite general, and charge ac-

cordingly. One must have quite a knowledge of ancient history to know just when or how many failures there will be in a new pavement. The only thing the contractor should justly be expected to do is to roll his street bed properly, put in a foundation suited to the general condition and finish the street. The city engineer or superintendent should see that he does this. The time is past when a contractor will undertake to do a skin job on work of this kind. Generally speaking, he will do as well as he can for the money paid and with the material in hand. If there is a failure it is for reasons not within the power of the contractor to correct.

When we look over a great city like Paris, and see asphalt, stone blocks and wooden blocks on the heaviest traveled streets, we come to the conclusion, with the evidence at hand, that no one can say which is altogether the best. However, it would appear that stone or granite has the greatest lasting qualities, that asphalt makes the smoothest and most beautiful pavement, and that wood is the best for general travel, is the most comfortable for the horses and is altogether the most noiseless.

Here it is: we pay our money and take our choice.

Wooden pavement must necessarily be a much more expensive one than when of the same material in America, and when we bear in mind that new streets of this kind are being put down in Paris at a very heavy expense we must recall the fact that the authorities here must know what they are doing when they select so very high priced a material.

I spoke of the fact that some of the stone pavement in the Louvre had been removed. The blocks therefrom were taken to another part of the city, turned upside down, bedded in sand and used where travel is less heavy. In this way the stone is shifted around from place to place until it comes to be used on edge in court-yards where very little is expected of it. There is an economy and thoughtfulness in all this which does not generally belong to a municipal organization of an American city.

The sidewalks of Paris are almost universally of asphalt. Those on the wider streets and boulevards are almost exclusively of this material. The base or foundation is of five or six inches of concrete, on top of which is placed a bed of asphalt not more than an inch thick. Oftentimes, where one sees where they are cutting a sidewalk in two, putting down gas pipes, making connections and doing work of this kind, it will be noticed that the sidewalk has not more than half an inch of asphalt, though the cement is rarely or never more than five inches. Whenever a weak spot appears in the walk, it is reported by a policeman to the municipal authorities and immediately repaired. For instance, last Sunday morning, when I walked out on the street where I am living, I noticed that four or five places had been cut out and filled in with new asphalt. I had casually passed over this before two or three times a day, but had not noticed anything wrong. However, some one had discovered that it was getting thin and it had been removed. A stitch in time saves nine. It must be borne in mind that this concrete is not particularly hard, though it is as uniform as can be made.

It is only in the narrower or older streets of Paris where stone sidewalks are used. Curb stones are about ten inches thick, that is, they show ten inches on the sidewalk, and to the bottom of the gutter are from eight to ten inches. They rest on a concrete foundation below the face of the pavement. These gutters are set with the utmost nicety. I notice that in flushing them the attendant will turn the stream of water one way or the other from the hydrant by laying a piece of an old jute sack on one side or other. It is sufficient to turn the water either way desired. Especially is this true when the gutters are kept clean.

In order to secure this accuracy and nicety, great care in forming the foundation is necessary. Otherwise a little dam, a couple of inches, would not throw a volume of water one way or another from a hydrant. It is the regular and usual way of changing the course of a stream of water in the Paris gutters to throw a piece of jute sack into the gutter in a way to form a dam.

I spoke, in a former letter, about the way in which the street car tracks were made and the slight obstruction which they formed to ordinary travel. The pattern of track copied in illustrating this idea was suggested by that in Liverpool and Glasgow. I find a new suggestion along that line here in Paris. It is to be remembered that the track illustrated was set flush with the face of the street, and that in the center of the track was a channel about three-quarters of an inch wide and about an inch deep. It was assumed that the wide wheels of the average European vehicle would not find their way into a groove of this kind, and for which reason a street car track in the middle of a busy street would not be so seriously objectionable as in the case where the flange is formed according to the usual practice in America. The track in Paris is somewhat different from that illustrated in that only one rail has a channel to form the flange. The other rail is flat. This is just that much better. Instead of there being the two rails into which a narrow tire may pass there is only the one, and as both are set flush with the street there is really very little objection to them. It is to be borne in mind that no part of the track sets above the street—that it is flush therewith, with the groove in the center of one rail. The other rail is smooth.

THE INAUGURATION AND EXECUTION OF THE WORK OF BRICK PAVING.

By Chas. P. Chase, City Engineer, Clinton, Iowa.

[This article is not for those who have "been through the mill."]

WE say *brick* paving because, with the improved quality of paving brick and more experience in the construction of brick pavements, together with its comparative cheapness and durability, that material is more likely to be used in the future than any other, and to include pavements of other materials would too much extend this article.

THE LEGAL FOUNDATION.

The necessary ordinary expenses of municipal corporations are so great that it has been found to be impossible to do any great amount of paving and pay therefor out of the ordinary funds which can be raised within the prescribed limits of general taxation, consequently most states have found it necessary to authorize such corporations to provide by ordinance, or by-law, for doing such work and assessing a part or all of the cost to abutting property, and to issue bonds, in anticipation of the payment of the assessments, upon which to raise funds for immediate payment for the work; and as the laws of the several states differ, no specific suggestions can be given which would be applicable in all cases, but it is safe to say that the matter should be placed in the hands of an experienced and reliable lawyer who will do thorough and accurate work. The city officers should not attempt to do this work themselves, unless they have among them such a lawyer, and should not accept the services of an inexperienced lawyer, because they are offered gratuitously or furnished cheap, because when large expenditures have been made, assessments levied and bonds issued, if fatal illegalities should be discovered, a calamity would fall on some one, and perhaps many, and the corporation itself disgraced.

If a system of sewerage has been adopted, have it carefully looked over and all necessary amendments made; and if none has been adopted do so at once, exercising all the care and skill you can command, and provide for payment, special assessments, future extensions and connections, whether private or public, according as the state law may authorize.

Having the paving ordinance or by-law prepared with the utmost skill and caution, after a most critical examination of the state law and all the authorities bearing upon the question of assessments and bonds in all its phases, "cork up all the holes," and guard the interests and protect the rights of all who may be interested; but let the ordinance be clear, concise, brief as possible, chronological (providing the steps to be taken in their natural order) and complete, so that the whole process from the beginning to the end, in all its material parts, shall be set forth.

See that these ordinances (sewer and paving) are passed in *exact accordance with the state law and rules of the corporation;* that the

"yeas and nays" and names of officers voting (when required) are entered of record and the ordinances published as required by law and the evidence thereof preserved. The same care should be used as to all acts done under these ordinances, giving to a careful attorney the work of preparing all the papers and records for each section of paving from beginning to end, thereby avoiding painful errors that are likely to be discovered "too late," where "each one takes a hand in."

GRADES AND DISTRICTS.

Before any pavement is ordered, the grade of the street to be paved should be carefully established (if not done before) in the manner required by the state law or ordinances of the corporation, and also the grade of as many other connecting streets as may be necessary to insure harmony and the proper drainage; and if the grade has been previously established (especially if a long time before), it should be well tested and changed, if necessary, because it often happens that after many years the surface of the street has been gradually and imperceptibly lowered or raised, and improvements so made with reference to its actual surface by abutting owners that to cut down or fill up to the established grade would cause damage to abutting property and a vast amount of "kicking," all of which may be avoided by a timely change and adaptation of grade.

When the corporation is authorized to improve by districts or sections, such districts or sections should be next established as required by the statute law or ordinance, or by-law of the corporation.

SEWER, WATER AND GAS PIPES AND THEIR CONNECTIONS.

At least six months or a year before the pavement is put down (according to circumstances), all pipes in the district to be paved should be carefully and accurately laid and connections for abutting property made and extended to the inside of the curb, unless such pipes are laid in the alleys, which ought always to be done, if possible, to be nearer that part of the buildings connected and save disturbing the streets, especially after the pavement is laid. This gives the necessary time for settlement in the trenches excavated for the pipes.

These pipes *could* be put in just before the paving and the filling so returned, by puddling and ramming, as not to settle, but we have seldom known it to be done, because it is a well known fact that, by the necessary labor, more material can be rammed into a trench than has been taken out and the average laborer *will not* ram it equally; more will be returned in some places than others and the latter places are sure to settle and the pavement must be relaid in such places.

RESOLUTION OR ORDER FOR PAVING.

The corporation having provided for sewer and other pipes and caused them to be laid where necessary, and passed a general ordinance authorizing pavements, and provided the manner of ordering the same in each particular case, and having examined and fixed the grade, and districts or sections, is ready to order a specific district paved, which should be done by resolution (or in such a manner as the ordinance required), carefully prepared, specifying the district and part of the street to be paved, width, material to be used in a general way, and require samples to be furnished of such materials as are not well known, should refer to the *specifications of the engineer* for details of work and materials, as a part thereof, and contain an order to advertise for bids, fixing the time for receiving and opening the same, reserving the right to reject all bids, and such other matters as the ordinance may require.

To prevent mistakes and misunderstandings, it is advisable to attach to the specifications "instructions to bidders" and "form for bids" and a "form for bond of bidders," which bond the ordinance should require the bidder to give to enter into a contract, in case his bid is accepted, as well as a bond to fulfill the contract.

BIDS AND CONTRACT.

It is satisfactory and fair to call for bids for grading by the cubic yard; for paving by the square yard (which includes all above the subgrade), and for curbing, including setting, and back-filling, by the lineal foot, although any other reasonable form may be adopted, *unless the law prescribes a particular form*, in which case it should be followed.

If the officers of the corporation are not fully advised, they may advertise for a brick pavement with one course of brick and also with two courses (in which case the resolution should so authorize), and decide which shall be used after receiving the bids.

When the time fixed for opening the bids has arrived (the "bonds for bidders" having been first examined and approved), the bids may be opened, and, if all are unsatisfactory, rejected, or such one accepted as will, in the judgment of the officers whose duty it is to pass thereon, give the best pavement for the price required.

"Specimen bricks" should be furnished in all cases, and those accepted preserved as a part of the contract. Some hard burned brick that are not vitrified make good pavers, while brick from the same clay when vitrified become so brittle as to be greatly injured. When the clay is such as to retain its toughness after vitrification (which the experienced burner will secure in many cases by *proper annealing*), the vitrified brick are the best. Common observation, scientific investigation and *actual experience* prove that no brick are too good for pavement, and the best are those vitrified and made of the best material for vitrification. Probably not more than half of the brick plants at this time are making the best paving brick; some for want of suitable material, others for want of skill and capital.

As to size of brick, the common size is better than larger blocks on the whole. They can be more evenly burned, procured at a less price, furnish a better hold for traffic, and are less slippery and are easier handled.

In deciding the important question of accepting bids, no amount of "log-rolling," friendship, religion, politics, "life or death, or any other creature," should ever swerve the officers from the strict discharge of their duty, as the chosen and confidential guardians of the interests of the people among whom they live. Such a course will be for the best interest of all parties. If unsuitable brick are allowed to be used, it will be charged that brick for pavement is a failure and its use abandoned. "Ichabod" will be written on the walls of the kilns of the paving brick maker; "sold out to pay the bonds" on the walls of the city that has used them, with the mud still knee deep in its streets, while the contractor "goes hunting for another job."

When bids are accepted, a clear contract *in writing* should be entered into, which, with the specifications, should contain every substantial detail, with nothing left out to be orally understood, thereby avoiding all disputes and expensive litigation, and the required bonds should be filed with and approved by the proper officers.

[TO BE CONCLUDED NEXT MONTH.]

SIDEWALKS.

By F. M. Pickering.

A GREAT deal has been said and written regarding roadways, curbing, etc., and very rarely we see a few remarks on sidewalks. What has been sought after for many years is sidewalks and yardwalks that will stand the grind of friction foot-wear, the hardest thing to contend with as to the wearing qualities of any such pavements; stone and brick have long ago shown that they wear out from their own grit, which can always be found on their wearing or walking surfaces. Stone will absorb and hold water, and ice will cling to it in winter; bricks are always dirty and do not add value to property on which they are laid, and are always uneven on the walking surface.

Artificial stone, made with good material, and by men who thoroughly understand putting it down, will wear equal to granite

and always remain smooth on the walking surface and safe to walk on day or night.

In all large cities cement or artificial stone is fast displacing every other kind of material. A brick walk has always been faulty. Stone walks, either of sand or lime-stone, sawed or spilt, will not stand the wear equal to an artificial stone walk properly put down. No one has ever discovered a way whereby a large or small stone can be placed in position, on its bedding, so that it would rest plumb and even with balance and up to its proper grade. Necessarily the workmen must put a little sand under the edges and then we have a slab resting on an edge foundatian only, and spanning over space. The first heavy rain or soft weather causes the water to run down between the joints, and soon washes away the little sand to be found there, and the stone settles unevenly down upon the original foundation, or cracks, leaving the walking surface rough and very uneven. The expense of any kind of a stone pavement is away in excess of artificial stone, and never as good. In the city of Cleveland, Ohio, where there is plenty of stone, they have long ago discovered that stone will not compare with the artificial stone, made of cements, either in price, durability, or smoothness; consequently, on all important streets, stone is being taken out and replaced with the artificial stone which, when properly put down, is giving universal satisfaction, as the walking surface is always even and not dangerous.

In artificial stone, the matter of necessary repairs cuts quite a figure, because of the little expense to make such repairs. In stone, if a slab becomes broken or cracked, it is necessary to take the entire slab out, and either chip off what can be saved (always at a risk of breaking) and put in a new small piece; or, to preserve the original effect, an entire new slab must be used, which must be hauled by a team and handled by not less than two men and a professional stone cutter, in addition to the cost of stone. In repairs on artificial stone, which are very rare, we do not find any extra labor, because the foundation can not be impaired, and never needs repairing, and should the walking surface become disfigured from abuse, such as a hole be picked into same with some sharp instrument, or tool, maliciously or by accident, or should it crack, through fault of the original construction, the only labor to repair it consists of *one* man with a wheelbarrow who, with necessary tools, can chip off the top or wearing surface, and mix up a little sand and cement, as in the original construction, and spread the new mixture into the place to be repaired. Many people have been under the impression that frost affects artificial stone walks, but in that they are mistaken, because these walks are now and have been in use for many years in our coldest climates.

MUNICIPAL ENGINEERING IN DENVER.

MR. J. A. McINTYRE, city engineer of Denver, in his annual report, says of the street paving there: "Too little of the asphalt paving has been laid and the time has been too short to be able to determine what effect climate and temperature will have upon the pavement. Wherever asphalt pavement, properly laid, has been used, it has proved a success, and there is no reason to believe that it will not prove so here. * * * Steps should at once be taken to pave the cross streets from Fourteenth street to Seventeenth street between Larimer street and Broadway, either with this or with other suitable material. And inasmuch as the storm-sewers are already in place, and it will only require short laterals for receiving basins, this work could be completed by the time Fifteenth and Sixteenth streets were finished. I also wish to call attention to the sample piece of native asphalt pavement, laid by the Denver Paving and Construction Company, at their own expense in front of the City Hall. This is a bituminous sand rock as nature made it, and is ground, heated and laid upon concrete foundation. The material is found in inexhaustible ledges in Colorado and Utah in the Rocky Mountain range. The owners claim that this material has been largely used in St. Louis, Ogden, Salt Lake and other cities. It would only be fair to give them a chance to demonstrate the value of their pavement, under such restrictions and conditions as would protect the city and the public. The sample as laid, I am candid to admit, exceeds my expectations, and has apparently worn as well as Trinidad asphalt. No defects or breaks can be discerned at this date, though it has been completed, now, nearly four months."

On the subject of paving alleys, Mr. McIntyre says: "The necessity of paving alleys is even greater than that of paving streets. Here rubbish and filth is hid behind barrels, boxes and all kinds of contrivances from the passer-by. The water from the roofs accumulates, and, with the gathered filth, soaks into the ground and causes sickness and disease. Stone blocks, laid on gravel foundation, with 14-inch flag in centers of alleys and joints filled with bituminious paving cement, would make an excellent pavement. The same can be said of sheet asphalt, laid under the same specifications as now in use for streets. Vitrified bricks, laid on gravel and sand foundation, have of late been extensively used for street and alley pavements. A factory has been started here in the last year for the purpose of manufacturing sewer pipe and bricks, and it is to be hoped that it will prove a success, and thus facilitate the procuring of better sewer material at less cost than now furnished by eastern manufacturers."

As to the parking of streets, he says: "In order to beautify our streets and to lessen the expense of repairing, I would recommend that a general ordinance be passed to establish the width of roadway in all 80 foot streets in the residence portions of the city at 35 feet, 7 feet for sidewalks (consisting of one stone only), and 15½ for parking. This strip of parking and the planting of trees thereon should be in charge of a commission of men experienced in horticulture and tree-planting, to select trees, mode of planting and protection of the same. No doubt experienced gentlemen could be found in this city who would be willing and cheerfully serve on such a committee without pay, and consider it an honor to contribute to the beautifying of our city."

In Denver the telephone and electric light wires have been placed underground in conduits. The system is described in Mr. McIntyre's report as follows:

"The conduit used is a square, burned-clay conduit, 10 inches square outside, having a longitudinal partition through the center, divided into two equal compartments 7¾ inches by 3¾ inches each. The material of which the conduits is composed is of the same kind as that used in sewer pipe. This style of conduit was adopted by this company as the best that could be used, judging from the opinions expressed by eastern telephone companies who have had considerable experience with the different kinds of underground conduits. Man-holes from four to seven feet in diameter are built of brick laid in Portland cement, the walls being thirteen inches in thickness. These man-holes are built usually one in every block or oftener. The cables or wires are cut in lengths corresponding with the distances between man-holes, and are then drawn into the conduits and afterwards spliced in the man-holes. 38,111 feet of conduit have been placed underground, making 228,666 feet of single duct. Capacity of the conduit as placed is 8,661 miles of wire. The lineal feet of trench dug, in which the above amount of conduit was placed, was 18,885 feet. The amount of wires already placed in the underground conduits is 1,175 miles. There are eighty-one man-holes. In all of our man-holes and conduits space is reserved for the police and fire-alarm wires of the city of Denver."

SIZE OF PAVING BRICK.

AN appropriation of $100,000 has been made to start the work of street improvement in Indianapolis this year. It is estimated that fully $10,000,000 will be required for all the street and sewerage work contemplated by the Board of Public Works. Mr. Defrees, one of the members of the board, says: "We have decided that where brick is used the standard shall be the size of the building brick. That size of brick can be burned harder, with more uniformity, wears better, and the brick unfit for paving can be used for building purposes. If the city did not adopt such a standard, it would have to keep a large stock of different kinds of brick on hand to make repairs with, and you can readily see what an expense that would be."

A NEW PLAN OF HIGHWAY CONSTRUCTION.

THE accompanying illustrations, from the *Railroad and Engineering Journal*, represent an improved method of road construction devised and patented by C. E. Keach, of Mapleville, R. I., Fig. 1 being a plan of a short section of road-bed; Fig. 2 a longitudinal section; Fig. 3 a cross-section on the line *x x*, Fig. 1; Fig. 4 a cross-section on the line *y y*, Fig. 1.

It will be seen that the road is divided lengthwise into a series of sections *A A A*, which are separated from each other by transverse rows *B* of comparatively large stones, while the spaces *A* between said rows are filled with smaller broken stone or stones and gravel. The rows of stone *B* are placed equidistant along the road-bed and serve as supporting-walls, which inclose the gravel between them and prevent the same from shifting, whereby the road might otherwise become uneven. Rows of stones *C* of about the same size as those of the rows *B* are placed on both sides of the road-bed and serve as walls in conjunction with the said rows *B*. Adjoining the rows of stone *C* and running lengthwise of the road are shallow drains *D*, which serve to catch the sand or other fine material which may be washed from the higher portion of the road-bed, and *C* the same can be made of gravel and cement or other suitable material, and in some cases logs of wood can be employed.

Dry-wells *G* may be provided at suitable intervals in the blind drains *F*, whereby the water from the drains will be absorbed by the surrounding earth or gravel.

Fig. 2.

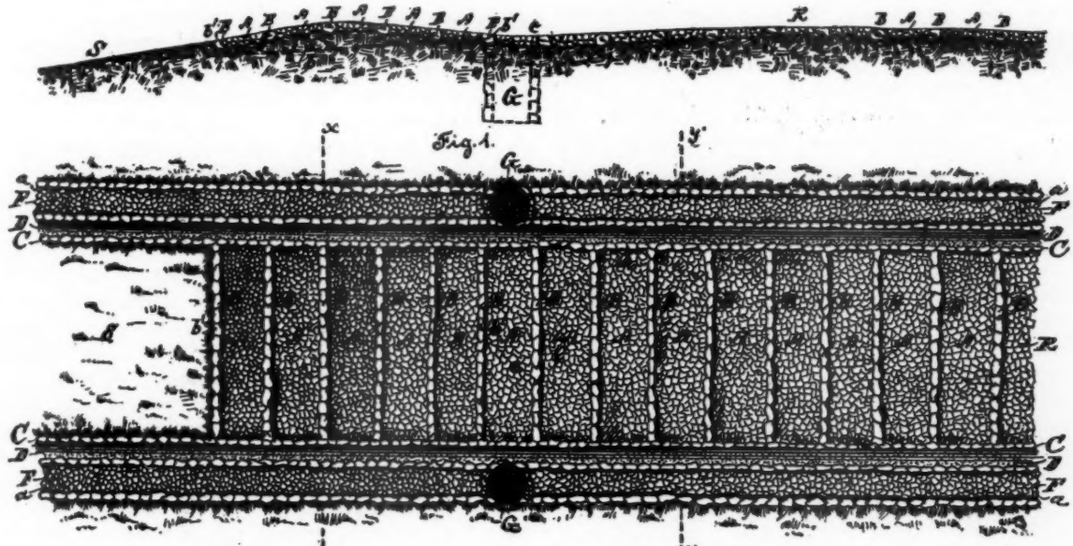
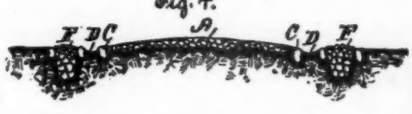


Fig. 1.

Fig. 3.

Fig. 4.



while the water which accompanies it will flow into the parallel deeper drain *F*, which latter is filled with cobble-stones *a*. The dry sand which is washed from the road-bed and settle in the drain *D* can be readily returned to the road-bed or be removed to a suitable place of deposit.

In order to prevent a rush of water from the comparatively level portion *R* of the road at the top of a hill *S* down the road-bed, so as to wash and gully the same, near the top of the incline *S* a shallow depression *c* is made in the road-bed; the water is drained from the same by the side drains *D*, which in this case are inclined, as is indicated by the dotted line *b* in Fig. 2, so that the portion of the road-bed included between the lateral rows of stone *b' b'* will form a raised dam or bar, which will serve to prevent the water from rushing down over the inclined road-bed of the hill *S* to wash and gully the same; and in this case also the dam will be constructed of a series of transverse rows of stone *B* with the spaces *A* between the rows filled with fine stone and gravel, and such dams or bars can be made at different parts of the declivity of the hill as may be required to properly guide the water from the road-bed.

In the absence of stone of the required size to form the walls *B*

WHAT GOOD ROADS ARE WORTH.

THOS. P. ROBERTS, Charles Davis, Alex. Dempster and Thos. H. Johnson have submitted to the Engineers' Society of Western Pennsylvania a final report on the improvement of country roads, together with a copy of a bill proposing a new road law for Pennsylvania. The first part of the report relates to the urgent necessity for better roads for developing the state internal traffic, and the arguments advanced are practically the same as those of the previous report of this committee made in March, 1889. Some portions of this, however, are well worth repeating, especially the parts relating to the difference in cost of hauling produce, etc., over good and bad roads. From the old experiments of Morin, still recognized as an authority, the committee prepared the following telling exhibit, one that any man can read:

AVERAGE LOADS FOR ONE HORSE ON DIFFERENT ROADS AND GRADES.

KIND OF ROAD.	GRADE.		
	10%	5%	Level.
	Lbs.	Lbs.	Lbs.
Street pavement, dry and clean	1,090	1,920	8,300
" " muddy	1,040	1,800	6,250
Macadamized Roads—			
Best, dry, clean and smooth	1,060	1,840	6,700
Good, moist or with little mud	1,000	1,660	4,700
Bad, ruts and muddy	890	1,390	3,000
Very bad, deep ruts and stiff mud	740	1,040	1,840
Clay Roads—			
Best condition	930	1,500	3,600
Average condition	660	900	1,400
Newly worked, not muddy	600	780	1,100

The above table needs little comment; but at the legal grade of 5°, or 8.85 per hundred, it means that the load of one horse is 1,150 pounds for pavement, 1,090 pounds for macadam, and 700 pounds for clay road, assuming each to be in good average condition. For average condition of each class of road, the loads hauled are in the following proportions, taking that of clay roads as 1:

	Macadam.	Pavement.
On level	2.75	4.46
On 5 per cent. grade	1.70	2.00
On 10 per cent. grade	1.43	1.58
On legal grade of 5°	1.56	1.64

In discussing the cost of handling the agricultural products of the state the committee figures that about 3,250,000 tons must be hauled an average distance of five miles to reach a market or steam conveyance to market. Two loads per day are assumed, and $2.50 per day is taken as the cost of a two-horse team. The cost of moving this tonnage over clay and macadam roads would contrast as follows:

	Clay Road.	Macadam.
Load for two horses	1,400 lbs.	2,180 lbs.
Number of loads for 3,250,000 tons.	4,643,000	2,981,000
Cost ($1.25 per load)	$5,703,750	$3,726,250
Difference	$1,977,500	

The $2,000,000 thus annually wasted is enough to keep 30,000 miles of turnpike in repair at annual expenditure of $66 per mile. Taken as days' work for a man and two horses, we have 2,321,000 on clay roads, and 1,490,000 on macadam; a loss of 831,000 days' labor, that could be devoted to other useful purposes.

Space forbids the reprinting of the act proposed for bringing about the desired improvement in roads, but we are pleased to note that especial stress is laid upon the qualifications of the man who is to control the work in each county. He must be a man of sound judgment and extended practical experience with men; a civil engineer of undoubted ability, and then be left alone with full responsibility for his assistants, whom he appoints.

A summary of principal points embodied in the proposed act will serve as a key to its general tone and purpose. This is given as follows:

1. Roads to be divided into two classes—roads and highways.
2. Highway tax to be levied on all property in the county.
3. State aid to be furnished each county for highways.
4. Thirty per cent. of state tax on corporations and seven and one-half per cent. of state tax collected in each county set apart for highways; and the portion of tax on corporations set apart for highways to be distributed among the several counties in proportion to the highway and road tax collected in the same.
5. Counties to construct and maintain all highways within their respective limits, under control of county officers.
6. Townships to construct and maintain all roads within their limits, under control of township road directors, with nominal compensation.
7. Road and highway tax to be paid in cash.
8. Provision for a more practicable and efficient system of road viewing.
9. A certain percentage of money contributed by the state, counties and townships for road purposes, to be expended in permanent improvements.
10. Cost of building highways and roads to be divided so that each interest benefited by the improvement shall bear its equitable share.
11. Providing a system of supervision which will not be too burdensome for the weaker counties, and which may be extended to meet the wants of the large and wealthy counties.
12. Providing for reports which will furnish reliable statistics of roads and highways of the commonwealth, and moneys expended thereon.
13. Providing for suitable protection for the public, where parties or corporations exercise the right of occupying, altering or changing the roads and the highways of the commonwealth.
14. Embodying in the law such general provisions as will be equally applicable to the different sections of the state, and leaving sufficient discretion with the officers charged with its execution to enable them to meet the peculiar wants of each district.

HIGHWAY REFORM IN TENNESSEE.

THE Nashville Commercial Club Committee on Highway Reform, of which Prof. Olin H. Landreth, of Vanderbilt University, is chairman, approved in their report several features of the bill proposed by the Tennessee Road Congress—viz., abolishing "civil district" lines in the collection and expenditure of road taxes, thus making the county the unit; putting the control of highways under a county commission appointed by and responsible to the county court; permitting a local option for the assessment of a labor tax in addition to the money tax; allowing the work on the highways to be executed either by hired labor or by contract, and requiring all appropriations and expenditures for highway purposes to be subject to the approval of the county court. The committee objected, however, to a number of other features and omissions of the proposed bill, due, doubtless, to the inadequate discussion it received during the meeting of the Road Congress. Among their objections may be mentioned the failure to require that the commissioner (only one being provided for each county in the bill) shall be an engineer, or that he shall employ the services of an engineer in the location, construction or maintenance of highways; the failure to exempt the streets within the bounds of incorporated towns from its provisions; the failure to require that work done by contract shall be according to written specifications; the failure to provide for a central State Board for advisory supervision, and the leaving of the erection of certain bridges in the hands of the county court.

On account of these defects in the bill adopted by the Road Congress, the committee have elaborated with considerable care, two others, which they proposed should be substituted in its place. The first of these bills is styled, "An act to regulate the laying out, construction, maintenance, repair and control of public highways and to repeal all laws in conflict therewith," and embodies the desirable features of the Road Congress bill, together with several others, of which the leading ones have been mentioned above. It provides for three county commissioners, one of whom shall be the county judge. The second bill is entitled, "An act to establish a state board of engineers and to prescribe the duties of the same." This central board to be called the Tennessee State Board of Engineers, is "to be composed of three engineers of recognized skill and ability, one from each of the three grand divisions of the state." A number of duties are assigned to it, such as considering and suggesting changes in highway laws; prescribing and determining the qualifications of county engineers; prescribing forms for permanent maps, records and reports of the county engineers, both for their own offices and for transmission to the State Board; preparing and distributing to county engineers recommendations on highway matters, and circulars and bulletins containing professional information; serving as a board of arbitrators between highway officials of different counties concerning questions in dispute; preparing and presenting to the governor and general assembly reports and technical papers; and any other duties which the governor and assembly may, from time to time, assign to them.

RELAYING A WATER MAIN.

DURING the past year there were relaid, at Malden, Mass., about 8,000 feet of pipe on one of the principal streets, replacing six-inch cement-lined pipe with ten- and twelve-inch cast-iron. Heretofore the usual custom was followed by Mr. S. M. Allis, the superintendent, when relaying, to dig a new ditch on the opposite side of the street, so that if any blasting was done it would not break the weak pipe before they were ready to abandon it.

On the street mentioned there were nearly 1,000 feet of hard ledge, as the street is built against a steep, rocky cliff, and it occurred to Mr. Allis that if they could take out the old pipe and use the old ditch they would find it comparatively easy digging, and save somewhere about $2,000. The last 2,800 feet to be laid was the only pipe that supplied the village of Linden, containing about 700 inhabitants. To take out this pipe and replace it with twelve-inch cast-iron, and not suspend the supply, was the problem to be dealt with.

Mr. Allis first connected three-inch adamanta pipe to a hydrant on the old pipe, using a reducer made to fit the steamer nozzle, as shown, and, crossing the street, laying the pipe under the street-

car rails and just beneath the surface in the roadway, putting on a quarter-bend. Then from there he laid, say, 700 feet of the same along the sidewalk or in the gutter until he reached a convenient place. There he crossed the street again and cut out the old pipe and connected with the further end by a common tee-branch and wound joint, first driving a wooden plug into one end of the branch and piling up a few large stones to hold it firmly in place. This form of connection is shown in Fig. 2, and was used also at points where there were no hydrants to which the temporary pipe could be connected.

Where services were required Mr. Allis had placed three-inch tees tapped for corporations as near opposite the stop-cocks as possible, and each one was temporarily connected with a short piece of lead pipe, after the water was let on. Mr. Allis then took out the old pipe (previously stripped), cleaned out the ditch, lowered it where necessary, proceeded to lay the new pipe between the points connected as above described. While this was going on the new pipe was tapped for services and ready for the corporation cock, and as fast as a piece of the work was completed for the day, it was connected at place of beginning. Then at the end of the newly laid pipe a cast-iron puddle plug, shown in Fig. 3, was bolted, attached to the services, and proceeded to fill the trench, first moving the three-inch pipe along and connecting with the puddle plug, restored the circulations temporarily suspended. As there were about seventy pounds pressure at the pump, the pipe used, although small, answered the purpose, and no complaint was made of want of water for domestic purposes.

ASPHALT AND WOOD PAVEMENTS IN EUROPE.

THE city of New York has recently appropriated $3,000,000 for pavements and $2,000,000 more than now asked for. The New York authorities claim to have profited in this matter by the experience of European cities. They have tried to, at any rate. Several months ago, Assistant Engineer Charles H. Bull, went abroad to inspect pavements there and to investigate the history and record of the various sorts of pavement in use in London, Paris, Liverpool and Berlin, cities that are usually held up as models in this matter for New York. His report is now before Commissioner Gilroy.

From portions of his report, the following statements are taken:

"I have spent a good deal of time in observing the effect of traffic over the various kinds of pavement, and in view of its recent use in New York I particularly observed the aphalt pavement. In 1869 an experimental piece of asphalt pavement, four hundred yards in area, was laid in Threadneedle street, London; that pavement, which, of course, has had many repairs made to it since it was first laid, still remains and is now in good condition.

"Soon afterwards, the cleanliness, the absence of noise and the comfort felt by the community generally from this asphalt pavement enlisted the favorable opinion of the public and led to the paving of Cheapside and the Poultry in 1870. These pavements remained in constant use nineteen years, and although, of course, they were extensively repaired, still, up to 1889 the carriageway was never closed entirely for a general relaying of pavement. In 1889 the contract for maintenance of the asphalt pavement in Cheapside having expired, a new contract was made and a new surface of asphalt was laid.

"After Cheapside, many of the streets in the city were paved with asphalt, and gradually the stone pavements of the whole of the main thoroughfares were replaced with either asphalt or wood, but mainly by asphalt.

"It may be mentioned that the wood pavement in several streets has since been taken up and replaced by asphalt, but in no case has asphalt been replaced by wood.

"Asphalt is in general use in Paris, Berlin and other cities of Europe in both business and residential streets, and under varying climatic conditions it is stated to wear well and give general satisfaction. The experience of these cities with the pavement is similar to that of London. It is clean and almost noiseless and can sustain quite a heavy traffic; and it is considered most economical, although I find that Paris and London pay much more for their pavement per square yard than New York does. As an instance I state the case of Capital Minores, in London, the street most recently contracted. The cost of the work including maintenance similar to that exacted by New York city for $4, would be $6 per square yard. In Paris the cost is even greater, the price averaging $8 per square yard. And in connection with this statment it should be remembered that the cost of labor in New York is much greater than in any of these European cities.

"The asphalt surface is from two to two and one-half inches in thickness," the report goes on, "and laid upon a foundation of concrete six inches thick, composed of one part Portland cement, six parts sand and eight parts broken stone.

"The pavement is maintained for a period of from fifteen to twenty years by the company which originally construct the work. They are paid a certain amount annually per square yard, depending upon the amount of traffic over the pavement, for maintaining the same in good order, and in case of any disturbance of the pavement by a corporation or by a private citizen, this company replaces such pavement at the expense of the corporation or citizen, and is responsible for its maintenance thereafter.

"A force of men is kept constantly at work making repairs to the pavements, and any defect, however slight, is remedied immediately.

"The life of an asphalt pavement, if kept in good repair, is considered to be from seventeen to twenty years. Threadneedle street, Cheapside and Poultry, in London, which were laid about twenty years ago, sustain an enormous vehicular traffic. The amount of travel over London streets may be appreciated when it is stated that 13,772 vehicles passed over the asphalt pavement in Cheapside in twenty-four hours, February 21, 1878, and in Mansion-House street, 23,332 vehicles in twenty-fours, February 22, 1888.

"Cornhill, Holborn Viaduct, Newgate street and others have a daily traffic of from 8,000 to 12,000 vehicles over their asphalt pavement.

"A great deal of wood pavement is also used in Paris and Berlin, but while it is very popular in Paris it is not so favorably considered in London or Berlin as asphalt. In London it is found necessary to remove and replace the wooden blocks about every fourth year, and, although noiseless and better suited for the streets having steep gradients than asphalt, still for sanitary reasons or durability it does not compare favorably, in view of the fact of its being more easily polluted, retaining moisture longer and being harder to keep clean.

"Paris keeps its wood pavement in good condition at an annual expense of fifty cents per square yard. This seems to be too great an amount for New York to spend in the maintenance of this class of work."

Engineer Bull's report concludes with a recommendation of asphalt as the best pavement for residential streets, and states that this opinion is concurred in by Col. Haywood, engineer of the city of London; M. Hult, of Paris, and Dr. Hobrecht, city engineer of Berlin.

AN OLD SEWER.

IN recently cutting a channel through the beach at Eaton's Neck, on the northern coast of Long Island, an old wooden sewer was uncovered at a depth of about seven feet below the surface. It is said to show every indication of having been built over a century ago. The sewer was unearthed to about one hundred fifty feet in length, and is built entirely of chestnut planks from three to four inches in thickness, which had been hewn out of the timber.

The planks are in a good state of preservation, the wood being bright and sound to about half their thickness. Even the marks of the broadaxe used in hewing are discernible, and the locust pins with which the planks are fastened together are almost entirely free from rot. Not a scrap of iron enters anywhere into its construc-

tion. The whole is about 1x2½ feet inside, the bottom planks running lengthwise the same as the sides, while the top planks are pinned on crosswise. The sewer is pinned to cross pieces like railroad ties, which are placed only a few feet apart, and the top loaded with heavy rocks. The oldest residents of the neck say they knew nothing of its existence, nor can they conceive why and by whom such a sewer was built.

A NEW PAVEMENT.

SOME time ago an experimental section of street pavement, composed of wooden blocks and cast-iron supporters, was laid down in Sheffield, England. The accompanying engravings, from *Iron*, illustrate a further experiment in the same town on similar lines, but instead of cast-iron, as in the former case, wrought steel is used in combination with wood. In place of the cast-iron upright stud of a cruciform section previously used at the angles of the blocks, there is now an angle-piece of steel (fig. 1), having a base or foot

FIG. 1.

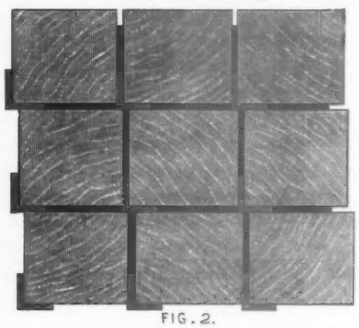


FIG. 2.

which rests directly on the concrete foundation. The advantages of steel over cast-iron are obvious, but the difficulty has been to adapt steel in such form as would be producible without making the cost so great as to preclude its general adoption. The first piece of combined wood and iron paving has now been in use three years, and shows little or no sign of wear. The piece described in our previous notice is still in use under exceptionally heavy traffic. The third piece, which comprises about 100 square yards, has been laid down in Queen street, Sheffield, where there is a great amount of traffic. Half of it is in cast-iron, but of much lighter construction than that in Savil street; the other half is in steel, as shown in fig. 2 of our engravings. It has been in use seven months. This pavement is made by the Carmaxill Road Paving Company, of Sheffield.

OHIO'S LAW FOR THE PROTECTION OF ROADS.

THE Ohio Legislature has passed a law for the protection of country roads, by requiring that all vehicles carrying over 2,500 pounds shall have a broad tire. The law will go into effect June 1, 1891. It is as follows:

SECTION 1. *Be it enacted by the General Assembly of the State of Ohio*, That in any county in this state having at the federal census of 1880 a population of not more than thirty-three thousand five hundred and fifteen, and not less than thirty-three thousand five hundred and ten, the county commissioners shall have power to enforce the following regulations as to burdens hauled over all free turnpikes or improved county roads, viz: For vehicles carrying a burden of over twenty-five hundred pounds and not over thirty-five hundred pounds a three-inch tire shall be used; for vehicles carrying a burden of thirty-five hundred pounds and not over four thousand pounds a three and one-half inch tire shall be used; for vehicles carrying a burden of over four thousand pounds and not over six thousand pounds a four-inch tire shall be used; for vehicles carrying a burden of over six thousand pounds and not over eight thousand pounds a five-inch tire shall be used; and for vehicles carrying a burden of over eight thousand pounds a six-inch tire shall be used.

SECTION 2. The County Commissioners of any such county, shall, at the first regular meeting after the passage of this act, agree upon the enforcement of the provisions of this act, and enter their proceedings upon record, and shall thereupon give notice by publication that it will be enforced from and after June 1, 1891.

SECTION 3. It shall be the duty of any constable, marshal or other officer having police power to arrest any person found violating any of the provisions of this act, who shall be fined not less than five nor more than twenty-five dollars with costs by any mayor or justice of the peace in said county.

MANAGEMENT OF MUNICIPAL WORK.

A BOARD of Public Works is about to supercede the minor branches of the old city government in Newark, N. J., which cared for the paving, sewage, water, etc. The city seems to have outgrown the old methods of detached branches of public work, and now will unite such branches under one general board of public work. The old offices of city surveyor and street commissioner and the old water and sewer departments are abolished.

Many doubt the advisability of this consolidation, etc., but with a good commission and efficient employes much good can be accomplished. Naturally a change like this injures a few old and faithful workers for the city, but they will probably be retained under new titles. The tendency in these days is in the direction of centralization of municipal contracting power. It is a departure from political management of city affairs, and is a movement toward business management, which is better both for the public and the contractors. Indianapolis is one of the American cities in which this new method has recently been introduced, and the results thus far have, from every point of view, been highly gratifying.

BETTER ROADS IN ILLINOIS.

THE movement for better roads has been taken up by the Illinois Society of Engineers and Surveyors, which has petitioned the legislature to appoint a commission of three senators, five representatives and five citizens to be appointed by the governor, two of whom shall be civil engineers, to report to the next legislature on the most practicable legislation to facilitate improvement of roads. The present law permits assessments up to 60 cts. per $100, or about $2,400 per average township, with an average of 60 miles of highways. The highway commissioners can at times levy 20 to 40 cts. more, and the township can vote to raise still more; but this and other "permanent road law" are practically dead letters. It is desired to imitate the Ohio law, by which the county bears one-fifth, the township one-fifth and the property owners three-fifths of permanent improvements, improvement bonds being issued to distribute the expense over a term of five or more years; but even this can not be done without a constitutional amendment. Therefore a commission is sought meantime.

ROADS AND BRIDGES IN MASSACHUSETTS.

A COMMISSIONER of highways and bridges is proposed as a state official in Massachusetts, and a bill prepared by the League of American Wheelmen authorizing such an appointment has been submitted to the legislative Committee on Roads and Bridges. The commissioner is to be a civil engineer and to hold office for a term of three years. His salary is to be $3,000 per annum and he may expend not more than $3,000 per annum in necessary expenses. An office is to be provided in the city of Boston. He is to have a general advisory oversight of roads and bridges, to make annual inspections, compile statistics, and make an annual report to the legislature. He may be consulted by public officials, and upon the representation of ten inhabitants of any city or town that any bridge or road is in an unsafe condition he is at once to examine the same and notify the aldermen or selectmen of its condition.

FOR MUNICIPAL IMPROVEMENTS.

To the Editor of Paving and Municipal Engineering:

There is perhaps no one in the states who is more alive to the requirements of cities, at least in the way of sewerage, water, streets and roads, than is Hon. Lawrence E. McGuire, the present superintendent of streets in Chicago and congressman-elect from our second congressional district. Your readers will be surprised to read of the propositions which this Irish-American has so well in hand, so that it gives me pleasure to say that it is his pet scheme to compile a "Blackstone" on the common law of road-making. The compilation would be in the hands of experts, and although a very large volume must be required the value of the same would be incalculable. Outlined, the work would represent generally,

considered *seriatim*, first, sewers. These would be faithful copies of our natural drains. That is to say, cone-shaped, so that large requirements would have large capacity, while, at the best, small pipe drainage would be ample. Briefly, 100 inches at the outflow and 6 inches at the head ten miles away—water to be pure and abundant at any cost. Streets and roads to have water and frost-proof foundations, flat crowns, quick gutters and such a top or wearing coat as the local conditions demand, irrespective of cost, which, of course, must be reasonable. All thinking minds agree that the cost of the foundations of our streets can not be reduced below a certain specific figure. Our people generally get the cart before the horse by making the wearing cost of greater importance than the foundations. This can be illustrated as well as in any other way by suggesting a cedar post foundation for a brick dwelling. They may succeed temporarily in getting it out of sight, but, as in streets and roads, it will not keep down. A word for our street cleaning, and I assume it to be nearly alike in all cities. For the past four months the streets of Chicago, which are paved or sandy, have been kept clean by the indomitable efforts of Superintendent McGuire. We happen to know that when, in the January number of PAVING AND MUNICIPAL ENGINEERING, we showed 288 deaths in the city during the month of November, directly traceable to unclean streets, while the month which has just passed took away 3,224 of our citizens, a very large percentage directly traceable to unclean streets, Mr. McGuire determined to clean the streets at any economical cost. On dit: Patterning Indianapolis, a club committee, consisting of Messrs. G. F. Bissell, John H. Hamline, L. McGuire, Runnells and Tuthill, has been formed to push these important matters in our city, and although all are ignorant of the alphabet of the work except McGuire, they can safely follow him. So, you see, that your own commercial club must look to its laurels.

W. L. S. BAYLEY, C. E.

NEW MOVE BY THE ENGINEERING ASSOCIATION OF THE SOUTH.

THE Committee on Highways of the Engineering Association of the South has submitted a report which recommends that a Standing Committee on public highways be appointed consisting of one member from each state represented in the membership of the Association, the duty of which committee shall be to secure, as frequently as practicable, short and pointed papers from members and others known to be informed on the subject, to be read and discussed before the meetings of the Engineering Association and to be printed as full as possible in the press of the several states, and further, that the Association from time to time, pass such resolutions on the subject of public highways as may be applicable to any particular state or county to which the attention of the Association may be called and to take measures to communicate such resolutions to such persons as are in authority as expressive of the interest taken by this Association in any movement made toward elevation of the public highway system of the country.

SEWERAGE OF INDIANAPOLIS.

CHARLES B. FLETCHER and George W. Bender, of the special committee representing the Commercial Club of Indianapolis, have submitted a report on the sewerage of Indianapolis, which they have been engaged in investigating for about a year. Of the seventy sewers in the city they found many in very bad condition, and recommended that several of them should be at once removed. They advised the designing of a new system, and the disposal of the sewage by farm irrigation, by filtration before delivered into White river, or purification by works similar to those of Worcester, Mass. Their report, which was prepared with much care and is of great value, has been referred by the Commercial Club to the Board of Public Works, and it is expected that under their direction the construction of a new sewerage system will soon be begun in Indianapolis.

THE PAVING-BRICK TRADE.

Nearly all the brick manufacturers of the country report that they have already made contracts for all the brick they can manufacture during the next several months. The demand far exceeds the supply, especially in the south and west. Inquiries are constantly being received from different parts of the country asking where paving brick can be bought. As we have before suggested, capitalists desiring to make highly profitable investments in manufacturing can find no business promising surer or larger profits than the manufacture of first-class paving brick. There is a demand for the material in almost every city and town where paving is done.

Mr. Joseph Fairhall, vice-president of the Grape Creek Coal Company, who is engaged extensively in the manufacture of paving brick, says: "Up to the present time the demand has exceeded our supply, and we have never been able to keep up with our orders."

The London Clay Company, which makes a first-class paver, has many large contracts for this year, but reports that it is able to fill some additional orders.

The Malvern Clay Company, of Malvern, O., is making from twenty to thirty thousand paving brick per day.

The New York Brick and Paving Company, of Syracuse, N. Y., has sold all the paving brick that can be made with its present plant this season; but it is now doubling its capacity so as to be able to take further orders later in the year.

The Franklin Vitrified Brick and Terra Cotta Company, of Leavenworth, Kan., is putting in a paving-brick plant, for the purpose of supplying the demand for paving brick in Kansas City and neighboring cities. D. C. Goodrich is secretary of the company.

The town council of Sullivan, Ind., resolved to pave about a mile of street in sections forty, twenty-four and twenty-one feet wide, using hard pavers made of the semi-fire and surface clays at that place. Besides the clays above mentioned, there are valuable deposits of fine potters' clays in that vicinity and plenty of cheap coal.

PUBLIC WORK IN TOLEDO, O.

THE annual report of City Engineer Wickenham, of Toledo, Ohio, for 1890, shows that 13.1 miles of streets in that city were improved by paving, macadamizing and planking; embracing 180,000 square yards of paving and macadamizing and 6,716 lineal feet of eight foot plank road. The total length of streets graded was a fraction over five miles. The total cost of these street improvements was $489,813.17. The side-walks constructed amount to 29.7 miles of plank and 7¾ miles of stone walk, a slight falling off from the previous year of stone walk and an increase of plank. The cost of this work was $96,354.65; eight miles of sewers were constructed at cost of $66,194.47.

There are now in the city a total of seventy-two and one-fifth miles of improved streets, fourteen and one-tenth of which are plank road. The city's system of drainage embraces 68.80 miles of sewers ranging from one to six feet in diameter the construction of which cost $1,106,818.09.

SAPLESS CEDAR BLOCKS.

MR. R. W. ROBERTS, city engineer of Saginaw, Mich., where there are 150,000 yards of sapless cedar block pavements in use, in reply to a recent inquiry as to the condition of the paved streets of that city, says: "I have closely observed our cedar blocks, and I can say from experience that the sapless machine made paving blocks have more merit and will give more service than is supposed can be obtained from a cedar block as a paving material by any one who has not had an opportunity to see the two kinds of block side by side, on streets that are similarly traveled. Every yard of our sapless cedar block pavement is in prime condition, and so far we have not expended one dollar for repairs. The surface of the streets paved five years ago with the sapless block are to-day in good condition; and equally as good to drive on as a new pavement, and I attribute it to the use of sapless block."

PAVEMENTS IN ST. LOUIS.

IN reply to inquiries from a number of cities and towns for details on the pavements of St. Louis, Mo., Mr. Thos. H. Mackenzie, district engineer, in charge of reconstruction, has supplied the following information, the pavements being rated in the order named:

Granite Pavement.—For manufactory and mercantile traffic, granite set on a base of hydraulic cement concrete 8 inches deep, 2 inches sand cushion, stone 7½ inches to 8½ inches deep, 3½ inches to 4½ inches wide and 8 inches to 12 inches in length.

Cost in St. Louis in 1890, 37 to 42 cents per square foot complete in place, exclusive of curb; curb costs 70 to 90 cents per foot, lineal.

This form of pavement has been down 17 years, under a traffic of 6,000 teams per day, of twelve hours, width of roadway, 50 feet between curbs; cross-section camber, 0.60; cost of maintenance, one-fourth of a cent per square foot per annum.

Cleaned by horse sweepers; cost per 10,000 square feet swept, 50 cents; swept three times a week; to sweep 10,000 square feet by hand costs from $1.00 to $2.50.

Two-horse wagons on 3 or 4 inch tires, loaded, average 7,300 pounds; team, 2,400; wagons for hauling railway cables and machinery weigh 9,700; width of tires, 14 inches; load, 97,000 to 100,000 pounds, drawn by 40 horses; horses average 1,400 pounds.

Asphalt Pavement.—This roadway, laid on Pine street by the Barber Asphalt Company in 1883, is now in good condition after a test of eight years, under a mixed traffic of 3,000 vehicles, in twelve hours, from 7 A. M. to 7 P. M. The work was carefully executed, and consists of a 6 inch hydraulic cement concrete base, ½-inch cushion coat, and 2 inch surface of wearing coat; cross-section camber, 0.50; width between curbs, 36 feet. Traffic is what may be termed building materials, residence supplies and suburban; while it has been subjected to the heaviest loads hauled in the city with fair results, it must stand below granite for wear. Cost, 33 cents per square foot.

Maintenance under contract, one cent per square foot per annum, in the case of the roadway cited; maintenance under later contracts half a cent per square foot per annum. The maintenance clause in contracts runs for ten years, the first year at the cost of the contractor.

This form of pavement as laid here, all points considered, stands in the front rank under the conditions indicated.

Telford Pavement.—This form of pavement as laid on Lindell avenue, consists of a base course of random stone, set broadest face down, in lines at right angles with the street, 8 inches in depth, finished by wedging spawls into the open spaces, and breaking down the points to a uniform surface, then placing a 6-inch course of clean macadam; this is thoroughly rolled by a 10,000 pound four-horse roller, 5 feet in diameter and 5 feet face.

The surface is then finished with 2 inches of cement gravel rolled, then 2 inches coarse clean gravel, well wetted down and thoroughly rolled to a compact, smooth surface. This avenue is 60 feet between curbs, cross-section camber equals 0.80, average grade 1 per cent.; cost, complete, exclusive of curb, 12 cents per square foot.

The traffic, as observed in 1890, was 1,500 vehicles in ten hours, 65 per cent. being one-horse vehicles, 15 per cent. two-horse vehicles (on springs), and 30 per cent. two-horse wagons hauling dirt, building material, coal, etc. In 1890 the repairs on this avenue of 469,500 square feet cost half a cent. per square foot. Our macadam pavements are finished on the top in the same manner as Telford, costs 9 cents per square foot, and, for a traffic of from 100 tn 500 vehicles per day, does fairly well. Cost to maintain a macadam pavement under a traffic of 3,200 vehicles in 12 hours, on a 34-foot wheelway on Broadway, four cents per square foot per annum; has been reconstructed with granite.

Wooden Pavement.—This pavement has been in use, in a limited way (ten miles), from 1860 to 1882, laid under the Nicolson patents. The average life during that period was six years and three months.

Broadway, 50 feet between curbs, under a commerical tonnage of 2,500 vehicles in 12 hours, cost 4½ cents per square foot per annum. The wood used was cottonwood, burnettized. Decay began to develop from the third to the fourth year.

There were a few exceptions on Third street, traffic 2,400 vehicles in 12 hours, where, with repairs, a 6-inch block of prepared cottonwood, wore down to 1½ inches in seven years; width of wheelway, 26 feet; grade 1 per cent. All of this pavement was set on inch boards; average cost, 42 cents per square foot; 6 cents per square foot per annum without repairs; replaced with granite. Since 1884 the practice has been to set the blocks on a 6-inch hydraulic cement concrete base, the channels filled with hot bituminous composition. The channels are formed by iron studs driven in the side of the blocks to the head, which is half an inch The blocks are treated with chloride of zinc.

This work costs, sweet gum, 35 cents; white pine, 37½ cents to 41, and a half cent per square foot. Maintenance under a ten years' contract, half a cent per square foot. Decay set in, in this work, at the close of the third year. From the present appearance of these streets, the conditions being the same, the record of wood block pavement will not be changed. In 1890 the first cedar (round) block pavement was laid on Olive street, west of Grand avenue, on a 6 inch concrete base; it has the merit of being cheap, costing 20 cents per square foot complete in place, exclusive of curbstone. It is expected to wear from three to five years, when it can be restored say at 7 or 8 cents per square foot, or less, as the lumber market may change. Admitting it to last five years, it will cost 4 cents per square foot per annum minus repairs. Olive street, at the point indicated, has a mixed traffic of 900 vehicles in 12 hours. There is a double-track cable road also, which forces the traffic on straight lines, thus adding to the wear by adding a tendency to rut.

How Paid For.—All new work, except crosswalks and grading, is paid for by special tax assessed against the abutting property, based on the assessed value of the property per front foot, against which value per front foot bills are issued to the amount of 25 per cent. The cost of the work in excess of 25 per cent. of taxable valuation per foot is paid by the city. Reconstruction, the same, except the grading, which is included in the tax bills.

Cleaning and Sprinkling.—To reduce the dust nuisance to a minimum in the spring, summer and autumn months is a difficult problem. The first step is to pave the streets, when the cost will not be too onerous on the property; the second is to clean by sweeping, or such other method as will be efficient and least injurious to the street surface in the operation.

Freezing, thawing and moisture are especially injurious to the streets or roadways. The destruction from freezing can be reduced to a minimum by perfect drainage, thus relieving the surface of the roadway from moisture, by providing for its rapid discharge from the surface to a depth that will insure the general stability of the work. The mode of underdrainage, where needed, will be determined by the character of the sub-grade and other general conditions. One of the points in favor of the Telford foundation is the result of the numerous small openings in the base course of random stone, which act as drains (until silted up from any cause). They permit the rapid fall of the surface moisture to the sub-grade line and below.

It being a self-evident proposition that the drier the roadway the longer the life, and the more efficient the service, at the lowest cost of maintenance it remains to provide for the elimination of dust and mud from the problem of good streets. The first step in this direction is perfect cleaning, water being only used to dampen the dust or dirt, so as to allow being swept without smearing, or the dust being thrown into the air by the motion of the broom. Water, aided by broom work, may be used to advantage under favorable conditions to clean granite and asphalt streets, they being practically water-tight. Sprinkling in excess of those purposes should only be employed to cool the streets in hot weather. All paved alleys, in the paved districts, should be swept as often as needed to completely remove all dust and dirt, as the alleys contribute largely to the dust volume; also as a sanitary measure.

Telford and macadam streets can in many cases be swept to advantage during the dry summer months, as the dust when wet holds the moisture in the form of a mud plaster, to a serious injury of the street surface and consequent greater cost of maintenance.

CEMENT vs. WET AND DRY SAND.

THE liability to error in mixing cement with wet and dry sand is described by M. Candlot, and an abstract of his paper given in the *Journal* of the Society of Chemical Industry. Feret has pointed out the possibility of serious mistakes in the proportion of mixtures of cement and sand due to a disregard of the condition of the sand—whether wet or dry. This is demonstrated by the following table:

	Kilos.						
Quantity of water added to 100 kilos of dry sand.....	.....	0.5	1	2	3	5	10
Weight of a cubic meter of moist sand.	1458	1310	1238	1213	1209	1208	1260
Weight of dry sand contained in one cubic meter of moist sand.....	1458	1304	1226	1189	1174	1151	1149

It is obvious that the addition of comparatively little water largely increase the bulk of the sand—out of all proportion to the amount used. For instance, two per cent. causes the weight of a cubic meter of the moistened sand to decrease 269 kilos; that is to say, 18.5 per cent. of the original weight. Such difference would cause great fluctuations, hitherto generally overlooked, in the composition of mortar mixtures intended to be of a certain strength. —*The Engineer.*

ENGINEERING ASSOCIATION OF THE SOUTH.

AT the regular monthly meeting of the Engineering Association of the South, in March, President Atkinson announced the appointments for the standing committee on highways ordered at the last meeting of the association. The committee is to comprise one member from each state represented in the association. The appointments are as follows:

For Alabama, Mr. J. R. Carter, Birmingham, Ala.
For Florida, Mr. B. T. Burchardi, Fernandina, Fla.
For Georgia, Mr. A. V. Gude, Atlanta, Ga.
For Illinois, Mr. E. L. Corthell, Chicago, Ill.
For Indiana, Mr. C. O. Bradford, New Albany, Ind.
For Kentucky, Mr. John MacLeod, Louisville, Ky.
For Louisiana, Mr. J. Kruttschnitt, New Orleans, La.
For Mississippi, Mr. W. Starling, Greenville, Miss.
For New York, Mr. Wm. Stickney, Buffalo, N. Y.
For North Carolina, Mr. W. H. Bixby, Wilmington, N. C.
For Ohio, Mr. S. Whinery, Cincinnati, Ohio.
For Tennessee, Mr. E. C. Lewis, Nashville, Tenn.
For Virginia, Mr. C. W. Richardson, Richmond, Va.

President Atkinson extended an invitation to the association to hold its May meeting at Earlington, Kentucky, which is in the heart of the western coal field, and the invitation was accepted. In addition to the technical subjects to be discussed at that time, President Atkinson promised to controvert many of the principles established by Isaac Walton, and to give on that occasion ocular and experimental proof of the correctness of his criticism.

INSTRUCTION IN HIGHWAY ENGINEERING.

THE Massachusetts Institute of Technology, in Boston, is to have a course of instruction in Highway Engineering, for which the necessary funds have been provided by Colonel Albert A. Pope, of Boston, a gentleman who has been one of the most prominent leaders in America in the movement for better roads.

A JOURNAL FOR CONTRACTORS.

THE following from Mr. Wm. J. Nesbitt, of Detroit, Mich., is a specimen of many letters that are received by PAVING AND MUNICIPAL ENGINEERING: "I think your journal is just what should be in possession of every respectable contractor for paving in the country, if for no other reason than to further the laying of first-class and proper kind of pavements to the total exclusion of all inferior ones."

DANGEROUS USE OF STREET SWEEPINGS.

To the Editor Paving and Municipal Engineering:

IN a communication to one of our Chicago aldermen, City Engineer Rindlett, of St. Paul, tells how that city is kept clean, as follows:

The streets are cleaned by a department of the city. The asphalt streets are swept by hand, each man taking care of about 1,000 lineal feet. All other streets are swept by machinery. The garbage is collected under contract. *The street sweepings are used to fill low lots.* The garbage is disposed of by the Merz system. The total miles swept by machinery during 1890 was 2,380.57. The average cost per mile was $9.52. About 9 miles of streets are swept every day, 18.5 miles three times a week, and 7 miles three times in two weeks. Garbage is collected from residences three times a week and from hotels and boarding-houses daily.

We have now 41 miles of paved streets. The total area of the city is 55.44 square miles, or 35,433.3 acres. The total cost of sweeping the streets in 1890 was $31,636.03, and the total cost of collecting garbage was $11,000.

The italicized words are intended to call the attention of Engineer Rindlett, and whom it may concern, to the fact that those sweepings are poisons anywhere, and if used as indicated in large quantities, only the high latitude of St. Paul can save it from a pestilence. Yours truly, W. L. S. BAYLEY, C. E.

STREET CLEANING IN NEW YORK.

THE New York Advisory Street Cleaning Commission, consisting of Captain F. V. Greene, Prof. C. F. Chandler and three other well known citizens, has, after three months' investigation, submitted a report to Mayor Grant, stating that the present expenditure, even if well managed, is not quite large enough to clean all the streets thoroughly. For the latter purpose $1,800,000 per year would be required; to clean about forty per cent. of the streets thoroughly and the rest by machinery, would cost $1,500,000. The work can not be fairly well done for less than $1,250,000.

PUBLIC WORK IN OMAHA.

THE cost of public improvements of Omaha, Neb., up to the end of 1890, included $3,660,131 for 61.2 miles of paving and $1,331,958 for 84.83 miles of sewers. The work for 1890 amounted to $1,091,084 including $508,072 for 217,334 square yards of paving, $124,000 for 64,015 feet of sewers, $135,336 for city hall, and $21,613 for expenses of the engineering department. The paving prices averaged about as follows: asphalt, $2.54 per square yard; Colorado sandstone, $2.56; granite, $2.25; brick, $1.92; cedar block, $1.37.

PERSONAL.

Henry H. Carter has been appointed superintendent of streets of Boston, Mass.

D. M. N. Ross has just been re-elected city engineer of Mobile, Ala., without opposition.

E. Macaulay Hartrick, formerly city engineer of Galveston, Tex., is now U. S. assistant engineer in that city.

J. W. Howard, civil engineer, has taken a residence upon Belleville avenue, corner Oriental street, Newark, N. J., moving there from Governor's Island, New York.

A NEW SEWER PIPE CONSTRUCTOR.

A SEWER pipe machine is the latest to claim public attention. It is a Minneapolis invention, and the owners of the patents are confident that they will revolutionize sewer pipe making by its use. The new machine, with two men to operate it, can make 100 lengths a day.

The pipe is made of a composition of cement and sand. By the hand method a fifteen pound tamp was used in pounding the composition after it had been placed in the mold. This made a very weak pipe, as the weight was not sufficient to pack the material until it became firm. In the machine a 300 pound hammer is used to force the mixture into shape in one motion, and this makes a pipe that will stand a weight of 75,000 pounds without breaking, and such a weight is never placed on it.—*New York Telegram.*

Improvement and Contracting News.

PAVING.

Montgomery, Ala., will issue bonds for $50,000 for street work.

Vitrified brick paving is to be laid on Scott street, Little Rock, Ark.

The city of Louisville, Ky., has purchased four street sweepers, costing $450 each.

Cypress blocks will probably be used in much of the street paving of Augusta, Ga.

Allegheny, Pa., will issue street improvement bonds for $75,000, at four per cent.

Fairmont, W. Va., proposes to issue $20,000 worth of bonds for fire brick paving.

At Cleveland, Ohio, it is proposed to issue bonds for $300,000 for streets and sewers.

The highway committee of Holyoke, Mass., is considering the question of laying brick paving.

Wilmington, N. C., will soon vote for $200,000 in bonds for street improvements and sewerage.

Five hundred able-bodied laborers are advertised for to work on the streets of North Wilkesboro, N. C.

One block of Nutt street from Mulberry to Walnut street, Wilmington, N. C., has been laid with belgian blocks.

It is proposed that bonds for a million dollars shall be issued for paving and sewerage in Memphis, Tenn.

F. Knight, of Crown Point, Ind., desires the views of engineers in regard to cedar block paving for towns with light traffic.

Athens, Ga., has voted the issue of $75,000 of bonds for the purpose of commencing street pavements and building a sewerage system.

The contract for constructing Surf avenue, at Coney Island, has been awarded to O'Rourke & Dady, Brooklyn, N. Y., at about $257,000.

The city engineer at Kansas City, Mo. is making tests of the strength, wearing capacity and absorption of different grades of paving brick.

The La Grange Draining and Paving Company has been organized by L. P. Richardson, D. W. Corr and O. L. Stratton; capital stock, $100,000.

On April 2 the town of Reidsville, N. C., will vote to issue bonds to the amount of $50,000 for the purpose of street improvements and water-works.

In the last fourteen months there have been eight miles of streets in Waco, Tex., paved, and there are yet four miles under contract and being now laid.

At Buffalo, N. Y., the cost of street cleaning by the city is estimated to be $67,000 for the ten months from March 1, or nearly $200,000 per annum.

Danville, Ill., will pave some of her streets with Howell brick, or brick blocks, on two inches of sand and eight inches of broken stone well rolled.

George Fleming and others have incorporated the Adamantine Brick and Paving Company to operate the street paving patents of M. Levi, of Charleston, W. Va.

The work of extending Front street under the railroad tracks is now well under way, a large force of men and teams being engaged in the work. In a few days wagons can pass under the tracks without hindrance, Ft. Worth, Tex.

At a recent election in Roanoke, N. C., the treeholders voted to bond the city for $421,000, to be expended for public improvements. Three hundred thousand of this sum is for new streets, and $30,000 for miscellaneous improvements. The Norfolk and Western railroad will in addition spend $400,000 in improvments to streets leading to the property of that company.

There are at present not less than one thousand feet of concrete sidewalks of the regulation width, ten feet, in course of construction in Waco, Texas. This in conformity with an ordinance recently passed, and notifications are sent from the city secretary's office daily to property owners to put down concrete sidewalks. In the course of a year Waco will have sidewalks to be proud of.

The committee on streets of the Staunton, Va., council, recommends the use of Belgian blocks in paving Main street, from Lewis to Market streets; Augusta street, from Frederick to the C. & O. depot; New street, from Main to New Court House; New Court House street, from Augusta to New; Frederick street, from Augusta to Water. The total area of all this street space, 3,157 feet long and 28 feet wide, is 9,822 square yards; and at $2.25 per yard, the average cost of Belgian block paving, the whole cost of the improvement recommended will be $22,099.

The city council of Dallas, Texas, have found another "bug under the chip," at least so some of the aldermen would have it appear. The bids for paving Pacific avenue from Griffin street to the Central railroad state that the contractors would do all the work at a certain price, while the contracts call for all the work except at the intersection of certain heretofore paved streets. At these intersections the streets were cut down and the old paving blocks replaced. This work was done under the supervision of the city engineer, and the council asked for money to pay for the work. Some members object to the paying of money for work that the contractors are expected to do under their bids. But then the contract given between the city and the contractors based on the bids, excepts the work at the intersection of the streets named. The difference will amount to $4,000 or $5,000 to the city. Who is to blame for the differences between the bids and the contract has not yet been shown up, but left over for another time. The matter may become interesting before it is settled, but the chances are that it is purely a mistake.

SEWERS.

A sewer will he laid in West avenue, Buffalo, N. Y.

A sewer system will be established at South Orange, N. J.

A sewer will be built in Calhoun avenue, Bridgeport, Conn.

A sewer will be constructed in Kunkel avenue, Harrisburgh, Pa.

Sewers will be constructed in numerous streets at Rochester, N. Y.

A sewer will be constructed in North Adams street, Troy, N. Y.

Plans have been prepared for a sewerage system at Port Jarvis, N. Y.

A trunk sewer will be constructed in Willow street, Lockport, N. Y.

The town of Clarksville, Tenn., will issue bonds for a sewerage system.

A sewer will be built at Harrisburg, Pa., in Fifteenth street, at a cost of $1,400.

Town trustees have ordered the construction of four sewers at Berkley, Cal.

Ordinances before the council provide for extensive sewer construction at Atlanta, Ga.

The sum of $3,000 has been appropriated to repair the Main street sewer, Kansas City, Mo.

Dallas, Texas, will spend $1,000,000 in the completion of sewer, water and street systems.

A sewer will be built in McHenry street, Baltimore, Md., and $17,700 has been appropriated.

Newark, N. J., has awarded a contract to R. D. Wood & Co. to furnish 35,000 feet of sewer pipe.

A complete system of sewerage will be put in at Florence, Ala., during the next six months.

At Watertown, Mass., the town petitions legislature for permission to issue $100,000 of sewerage bonds.

The Erie, Pa., council has decided to build a portion of the third section of the intercepting sewer.

Joshua Chew has the contract for constructing sections A., B. and C. of the Cincinnati street sewer.

A bill before the council provides for the construction of a sewer in Almond street, Philadelphia, Pa.

Dubuque, Ia., will receive sealed proposals until April 24 for constructing sewers on Seventh and Wall streets.

H. McGoveny, of Jersey City, has been awarded the contract to build a sewer on Passaic street, Hackensack, N. J.

A bill authorizing the town of North Knoxville, Tenn., to secure a sewerage system has passed the Tennessee senate.

A force of men work day and night on the tunnel for the sewer main under the old city cemetery, at Ft. Worth, Tex.

The city council of Newport, R. I., has ordered that $70,000 in bonds be issued for sewer and street improvement work.

Fred Porath has the contract for five sewers, Aug. Miller, John Wagner and H. Liphardt for two each at Detroit, Mich.

During the spring and summer, Anderson, Ind., will build a system of sewerage involving an expenditure of about $75,000.

The board of public works at Chattanooga, Tenn., is arranging to advertise for bids for the construction of a sewer on Carter street between Hooke and Sanders. There will be 1,100 lineal feet of pipe, four manholes and three catch basins.

It has been resolved by the city council at Columbus, O., to construct a main sewer in Rich street from Wall to the Scioto river.

City council, Kansas City, Kan., has let a contract for constructing a public sewer in Twelfth street, from Bluff to Santa Fe, to James Pryor, at $25,000.

The contract for the construction of the ten feet four inch sewer on K street, Superior, Wis., has been let to G. J. Anderson, of that city, for $60,856.

Proprietors of the new Downer Place addition, Aurora, Ill., propose expending between $30,000 and $40,000 this summer in putting in sewers in their addition.

Sealed proposals will be received till May 12 for 3,350 feet of 24-inch salt glazed, vitrified fire clay sewer pipe for the Indiana State Prison South, of which J. B. Patten is warden.

At Salem, N. J., 2,000 feet of sewer pipe were laid last year, and 2,500 will be laid this year. The Warren system has been adopted, the plans being prepared by Mr. Gaskel, of Mt. Holly, N. J.

A train of twenty-five cars of sewer pipe, manufactured by the Lookout Sewer Pipe Company, was shipped over the Western and Atlantic Railroad to Columbia, S. C., and Brunswick, Ga., on March 18.

John J. Crilley has received the contract to construct a brick sewer from Ninth to American avenues at $24 per lineal foot, and H. Moore & Co. the contract for furnishing 9,000 feet of steel pipe for underground conduits for the fire telegraph at 17¾ cents per foot at Milwaukee, Wis.

Mr. Rudolph Herring, the expert sanitary engineer who was employed by the city authorities to make plans for a system of sewerage for Wilmington, N. C., returned to New York last night. He has made out a sketch of his plans. The plan in view by Mr. Herring contemplates that the sewers to be constructed shall empty into the river along the docks and wharves.

WATER-WORKS.

Rawlings, Wyo., will invest $35,000 in water-works.

Van Wert, O., has voted to build a new water-works system.

Waterville, Wash., will be supplied with a water-works system.

Ogden, Ia., has voted against putting in a system of water-works.

Carroll, Ia., will spend $10,000 in improving her water-works system.

A bill has been presented to allow Cleveland, Tenn., to vote water-works bonds.

Noblesville, Ind., has decided to construct water-works on the rental system.

There is talk of constructing water-works to bring water from Long Pond to Sorrento, Me.

The Erie, Pa., council has decided to build a portion of the third section of the intercepting sewer.

The aldermen of Waltham, Mass., have appropriated $20,000 for water-works construction and extension.

The New York City Suburban Water Company has been incorporated with a capital of $1,500,000, to supply water to Mt. Vernon.

An engineer has been figuring on water-works for McMinnville, Tenn., and there is prospect of the plant being located.

The Lower Marion Water Company has applied for an extension of the time for completing its works at Norristown, Pa.

The city authorities have granted a franchise to the American Pipe Company to establish a water-works at Opelika, Ala.

The contract for the construction of the New Berne water-works, has been let to Mr. Geo. E. Ladshaw, Spartanburg, S. C.

A contract for the proposed water-works extension at New Ulm, Minn., has been given to Gleason & Son, of Minneapolis, for $10,098.

The Brigantine Water Company, Brigantine, N. J., has been incorporated with a capital of $100,000, to build water-works. Hosea E. Doughty, of Atlantic City, is interested.

A bill was introduced in both houses of the legislature Monday to allow Johnson City, Tenn., to issue $100,000 in bonds to construct water-works.

The Bath and Brunswick water companies contemplate consolidating their plants, which will require the laying of four miles of pipe at an outlay of $50,000.

Ballinger, Texas, will receive sealed proposals for furnishing material and constructing a water-works system, until the fourth of May, each to be accompanied by a check for $500.

The city council of Terrell, Texas, has leased the water-works for a term of thirty years to O. J. Gorman and associates. This lease made, the company will incorporate within its organization the electric light plant now in operation, and also an ice factory, which is to be put in operation by September 1.

The Clarendon, N. C., Water-Works Company is soon to make some extensive improvements. Among other things, a twelve-inch main will be laid on Fourth street from Red Cross street in the northern section of the city to Church street on the south side. They are also considering the matter of removing the big stand-pipe from the pumping station to the location originally contemplated for it at the intersection of Fifth and Market streets.

BRIDGES.

Townsend, Mass., has appropriated $2,500 for roads and bridges.

There is talk of erecting a bridge over Cuyahoga river gorge at Akron, O.

The town of Plymouth, Mass., has voted to appropriate $11,500 for roads and bridges.

Plans have been adopted for a $30,000 steel bridge across the river at Napa City, Cal.

The Ohio Valley Railroad will erect a new bridge over the Ohio, just above Evansville, Ind.

A new viaduct over Lincoln avenue, Bay View, Wis., will be begun in June, and will cost about $10,000.

Dougherty & Co., Bellaire, W. Va., have the contract for rebuilding the Union street bridge at the creek; contract price, $3,056.

Council has passed an ordinance to authorize the construction of bridges on the line of Kensington avenue and on the line of Oxford street over the connection railway at Philadelphia, Pa.

STREET LIGHTING.

Citizens of Marshall, Ind., have voted in favor of electric lights.

It has been decided to build a $250,000 plant at Canon City, Colo.

M. L. Brown is interested in organizing an electric light company at Emmetsburg, Ia.

The Ashland, O., Gas and Electric Light Company, $50,000 capital, has been incorporated.

Gallatin, Tenn., will issue $10,000 of bonds for the purpose of introducing electric lights there.

The sum of $10,000 has been raised for the establishment of an electric light plant at Madera, Cal.

Citizens have voted in favor of an electric light plant, and arc lamps will be used for the streets at Marshall, Ill.

The East Alabama Improvement Company will establish an electric light plant for Phœnix City and Girard, Ala.

Elactors at Manistee, Mich., will vote on the question of appropriating $60,000 for the purchase of an electric plant this spring.

The Albany, Ga., council contemplates the substitution of arc lights for incandescent lamps in the business portion of the city.

Columbia City, Ind., is agitating the question of putting in a plant for electric lighting. The city clerk has the matter in charge.

The town of Revere, Mass., has voted to appropriate $4,275 for electric lights, and Plymouth, Mass., has $4,600 voted for street lighting.

The streets of Salineville, O., Shelden, Ill., Crawfordsville, Ind., Pendleton, Ind., and Davenport, Ia., are to be lighted by electricity.

The committee on lamps, at Cambridge, Mass., is investigating the different electric light systems, with a view to their introduction there.

The Columbia City, Ind., common council are contemplating the purchase of an electric light plant and also of having water-works put in.

The Ft. Wayne Electric Company have been awarded the contract to furnish the city of Bath, N. Y., with 35 arc lights of 2,000 candle power.

A bill before the Albany assembly provides that New York railroads shall cause all tunnels over 200 feet in length to be lighted by electricity.

The Bergen and Bayonne Electric Company offer to furnish the city forty arc lights of 1,200 candle power, each for $110 a year per lamp, at Bayonne, N. J.

The city clerk has been instructed to advertise for bids for lighting the streets of Chico, Cal., for one year with thirty 2,000 candle power arc lamps.

At Lancaster, O., the city council has contracted with the recently organized electric light company for sixty 2,000 candle power arc lights for all night service.

The corporate town company of Knoxville, Tenn., has been incorporated with a capital of $10,000,000 to build electric light and telephone plants, street railways, gas works, etc. Robert P. Porter, superintendent of census, is president.

The electric lighting company offers to light the streets at Sing Sing, N. Y., with 25 candle power lights for twenty dollars per lamp for the ensuing year.

Twenty thousand dollars has been appropriated by the council for street lighting purposes and will shortly ask bids for lighting the city by electricity, at Erie, Pa.

The citizens of Ida Grove, Ia., have formed an electric light company with a capital of $29,000, and propose having an electric light plant in operation by May 1st.

The contract for lighting the city of Portland, Ore , has been let to the Willamette Falls Electric Company, for arc lights of 2,000 candle power, monthly at $9.72 each.

At Salem, Mass., the light committee is considering proposals for lighting the streets by electricity, the town now pays 48 cents per light, burning from twilight till dawn.

STREET RAILWAYS.

Georgetown, O., will build a street railroad.

Al Johnson will build an electric railroad at Warren, Ohio.

A company has been organized to build a street railway at Talladoga, Ala.

The Bristol, Tenn., electric railway will be eight miles long and will cost $200,000.

Work will shortly be commenced on the construction of an electric railway at Wallingford, Pa.

Contract for the construction of the Broad Ripple Electric Street Railroad in Indianapolis has been let for $200,000.

The Ogden Street Railway Company, Ogden, Utah, incorporated with $250,000 capital; L. R. Rhodes, C. H. Nicolet, H. C. Gilbert, *et al.*

The Findlay, O., Street Railway Company have increased their capital to $200,000, and the main street line will be changed to an electric line.

The Rochester Railway Co., Rochester, N. Y., has petitioned council for a franchise to operate a double track electric railway on sundry streets.

The South Florida Electric Light Company contemplate building a belt railroad around the city of Tampa, Fla., to be operated by electricity.

The River Mont Company, of Lynchburg, Va., have contracted with the Edison Company for a double-track electric railway to cost $65,000.

The two street car lines in Milwaukee, Wis., with which Henry C. Payne is connected, will be equipped with electricity at a cost of $2,600,000, work to commence at once.

At Des Moines, Ia., arrangements have been completed to unite the Belt Line, a steam railroad some four miles in length, with the electric system, thus giving the city one complete system of street railroad.

A VALUABLE BOOK.

"Durability of Brick Pavements," by Prof. Ira O. Baker. T. A. Randall & Co., Publishers, Indianapolis, Ind. Price 25 cents.

The subject of street paving is a very important one which has not heretofore received the attention its importance deserves. The above publication is timely and will prove of special interest to Engineers, as it gives in a terse, yet comprehensive manner, the results of experimental tests made by the author, for the purpose of determining the relative value of paving brick as compared with stone, wood, and other paving materials.

The results, as shown in this little book, are suprisingly favorable to brick, and it will doubtless be accepted as a text-book by all interested in that line. The high standing and reputation of Prof. Baker, the author, as a civil engineer is ample evidence that the comparisons and statements are reliable and authentic.

A Victory for the Wagner Vestibule.

The Wagner Palace Car Company, operating Sleeping-cars over the Big Four Route, has gained a signal victory in its controversy with the Pullman Company. By the decision just rendered by Judges Gresham and Blodgett, in the United States Circuit Court at Chicago, the motion made by the Pullman Company to enjoin the Wagner Company from the use of the "Vestibule" is denied, and the Wagner Company is sustained on every point it has made in the contest. This decision practically disposes of the litigation, and leaves the Wagner Company a clear field in which to demonstrate the superiority of its perfected Vestibule, which is now in use on all express trains of the Big Four Route, making the trains practically solid from end to end, an advantage which will be readily appreciated by the traveling public.

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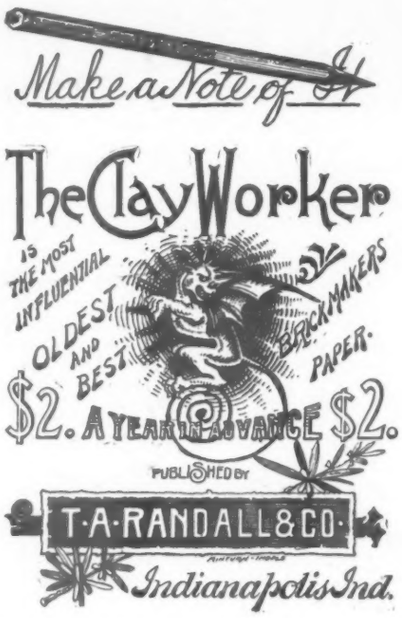

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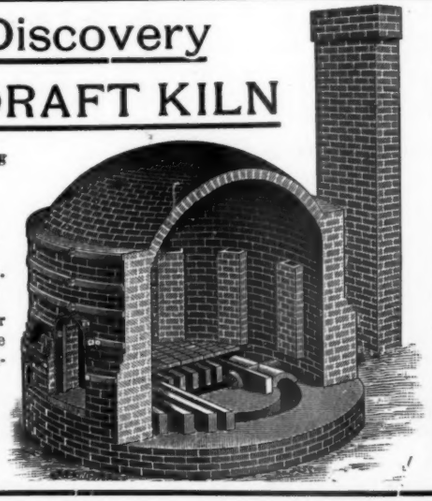

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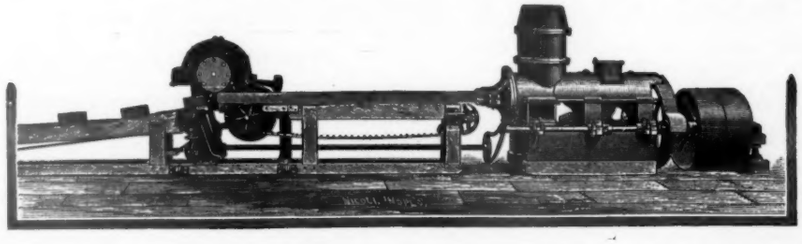

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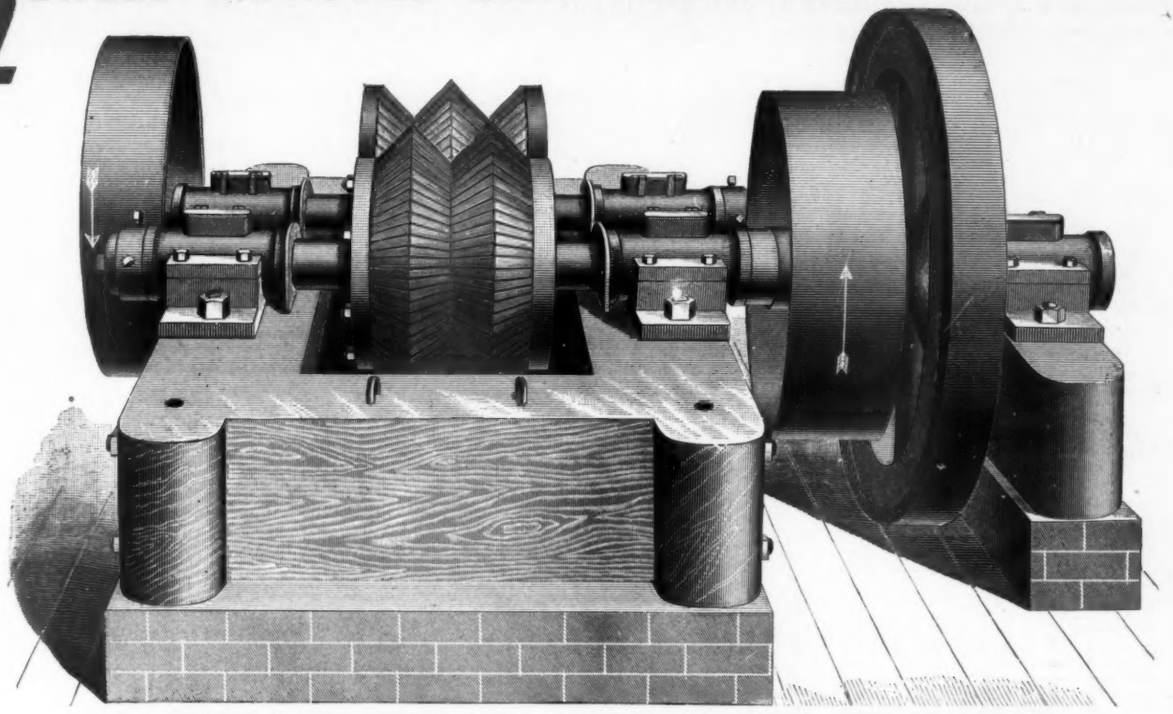

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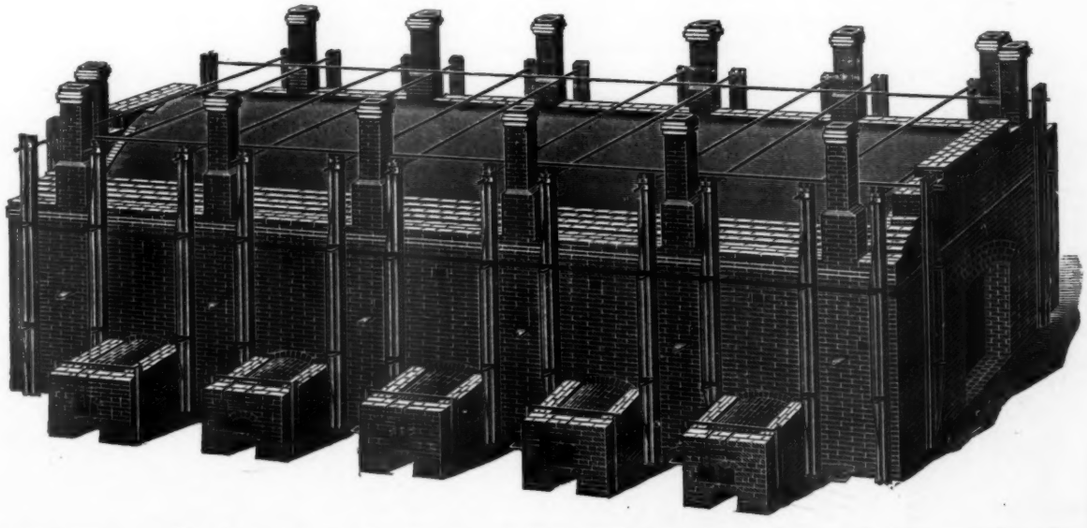

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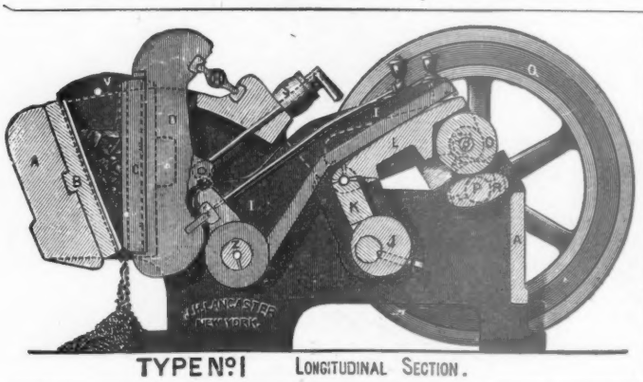

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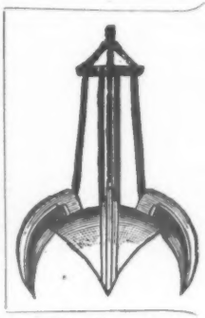

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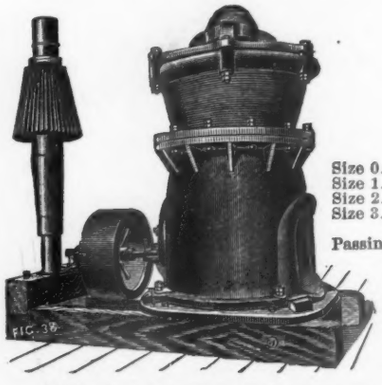

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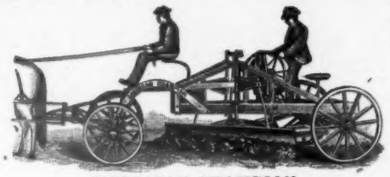

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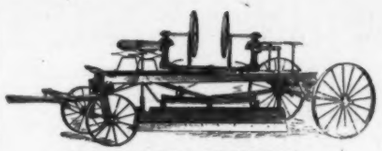

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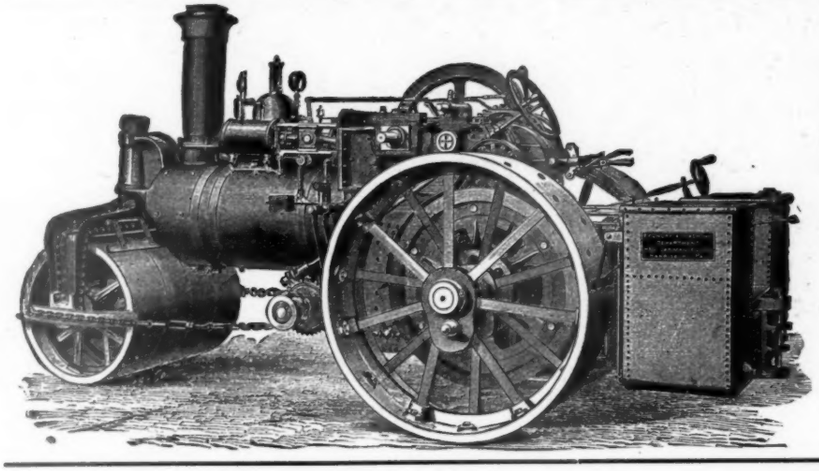

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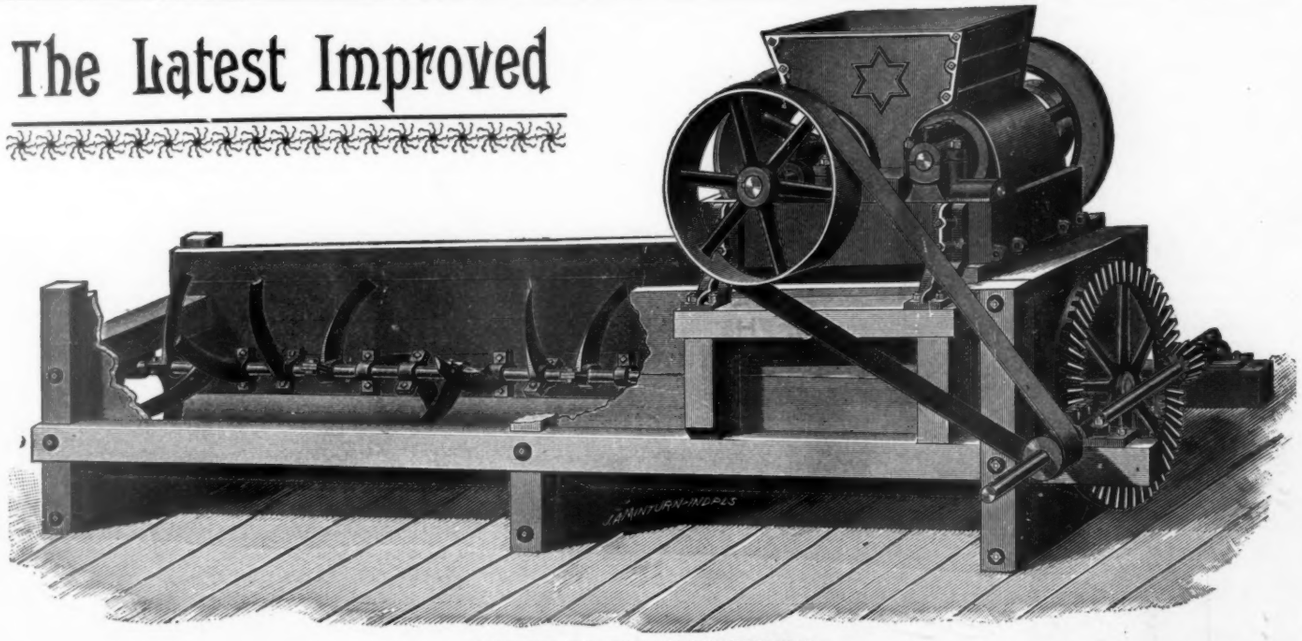

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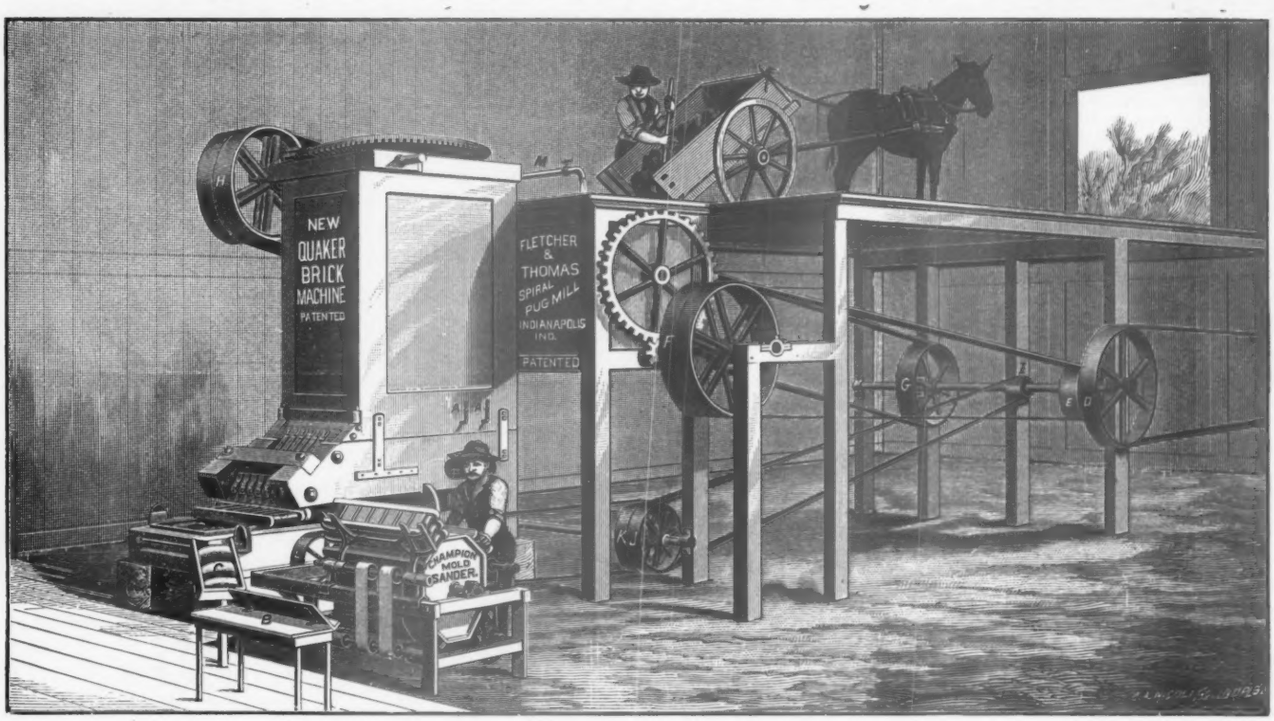

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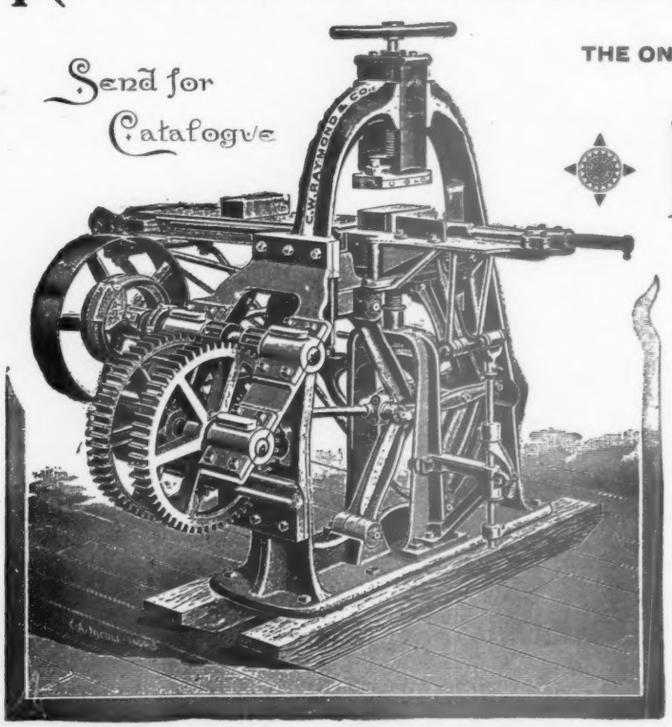

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